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Editorial

The Editorial Board on behalf of the Nepal Geological Society extends best wishes to all on the auspicious occasion of the happy new year 2055. The Editorial Board of the Nepal Geological Society is very happy to publish the new issue of NGS News Bulletin Volume 15. In addition to regular publication of the Journal of Nepal Geological Society, it is another important publication, which provides information about the role of geoscience in the infrastructure development, environmental protection, natural disaster mitigation, proper exploitation and use of mineral and water resources, etc. In this issue, it has been attempted to give information in brief about the various activities and events organised by the Society in the last one year time. The bulletin also includes few abstracts and papers presented in IDNDR Day on 6 October 1997 and some popular articles of common interest.

The activities of NGS is increasing year after years. Consequently, more materials are included to make the Bulletin popular not only among the members of the Society but also to the wider range of professionals within Nepal and abroad. It also includes popular geoscientific articles and other information on relevant topics.

Since last year, the form of the Bulletin is significantly changed. This year, we tried our best to improve its quality and are committed to increase its circulation in Nepal and abroad.

The Editorial Board expresses sincere thanks to all who have helped in various ways to bring out this volume. The Board is also grateful to all the advertisers, without whose support it would have been very difficult to bring out this publication.

LIST OF PUBLICATION OF NEPAL GEOLOGICAL SOCIETY

1. Journal of Nepal Geological Society, vol. 16 (**Special Issue**), November, 1997
(*Abstract Volume of Second Nepal Geological Congress*)
2. Journal of Nepal Geological Society, Vol. 15, June, 1997
3. Journal of Nepal Geological Society, vol. 14 (**Special Issue**), December, 1996
(*Proceedings of 1st Nepal Geological Congress, Kathmandu, 1995*)
4. Journal of Nepal Geological Society, vol. 13, June, 1996
5. Journal of Nepal Geological Society, vol. 12 (**Special Issue**), August, 1995
(*Abstract volume of First Nepal Geological Congress*)
6. Journal of Nepal Geological Society, vol. 11 (**Special Issue**), April, 1995
(*Proceedings of 9th Himalaya-Karakorum-Tibet Workshop, Kathmandu, 1994*)
7. Journal of Nepal Geological Society, vol. 10 (Special Issue), April, 1994
(*Abstract Volume of 9th Himalaya-Karakorum-Tibet Workshop*)
8. Journal of Nepal Geological Society, vol. 9, June, 1993
9. Journal of Nepal Geological Society, vol. 8, June, 1992
10. Journal of Nepal Geological Society, vol. 7, June, 1991
11. Journal of Nepal Geological Society, vol. 7 (**Special Issue**), February 1991
12. Journal of Nepal Geological Society, vol. 6, December, 1989
13. Journal of Nepal Geological Society, vol. 5 No. 1, August, 1988
14. Journal of Nepal Geological Society, vol. 4, No 1&2, August, 1987
- 15*. Journal of Nepal Geological Society, vol. 4 (**Special Issue**), June, 1984*
- 16*. Journal of Nepal Geological Society, vol. 3, No1&2, December, 1985*
17. Journal of Nepal Geological Society, vol. 2, No 2, January, 1983
- 18*. Journal of Nepal Geological Society, vol. 2 (**Special Issue**), May, 1982*
19. Journal of Nepal Geological Society, vol. 2, No 1, May, 1981
- 20*. Journal of Nepal Geological Society, vol. 1, No 2, 1981*
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The 18th Annual General Body Meeting of the Nepal Geological Society was held on 12th September 1997 (29 Bhadra 2054) at the conference hall of Hotel Classic at Kathmandu. It was attended by most of its members. In the beginning, Dr. B.N. Upreti, the President of NGS delivered a welcome speech. Mr. D.N. Subedi, the Secretary and Mr. Mukund Raj Poudyal, the Treasurer of NGS presented the annual report and financial report, respectively. It was followed by the active participation in the discussion on various important points and issues raised by the members of the Society.

The Nepal Geological Society in cooperation with HMG/Ministry of Home, Water Induced Disaster Prevention Technical Centre (DPTC) and UNDP/Nepal successfully organised a one-day National Meeting cum Seminar on "Natural Disaster Reduction in Nepal: Experience and Challenges" in the auditorium of Russian Cultural Centre, Kathmandu on 6th October 1997 to commemorate the UN declared International Decade for Natural Disaster Reduction (IDNDR) day 1997. It was attended by more than 250 persons involved in various disciplines. The inaugural session was chaired by Mr. Keshab Sthapit, the Mayor of Kathmandu Metropolitan City. Mr. R.R. Pokharel, Secretary, Ministry of Home was the Chief Guest who inaugurated the seminar and delivered an inaugural speech.

Nepal Geological Society in collaboration with the Ministry of Education, UNDP Nepal, Lutheran World Service, Disaster Preparedness Project and National Society for Earthquake Technology Nepal (N-SET Nepal) organized second time a two-day workshop cum training to the highschool teachers of Kathmandu Valley on "Natural Disaster Reduction" on 9-10 December 1997. The training was participated by 93 school teachers and 7 officers from the Ministry of Education and Kathmandu Municipality. The training was inaugurated by Dr. C.K. Sharma, Hon. Member of NGS and Academician RONAST. The inaugural session was chaired by Mr. Chuman Singh Basnet, Joint Secretary, Ministry of Education. In the training programme, information about the geology of

Nepal Himalaya, types of disasters, disaster management capabilities in Nepal and possibilities of reduction of the effects, preparedness, relief and rehabilitation was given to the trainees.

Nepal Geological Society in cooperation with Nepal Engineers' Association jointly organised a one-day Technical Workshop on "Tsho-Rolpa Glacier Lake" in the Auditorium of Russian Cultural Centre, Kamal Pokhari, Kathmandu on 28 July 1997. Experts on this field presented their papers and provided the information about it. It was attended by more than 200 professionals from different organisations.

In the beginning of the workshop Mr. Chet Prasad Bhattarai, President, Nepal Engineers' Association delivered welcome speech. It was followed by Technical Session. This session was chaired by Dr. Binayak Bhadra, Member, National Planning Commission.

The Technical Session of the workshop was started by an introductory lecture on Glacial Terminology by Dr. B.N. Upreti, Professor, Department of Geology, Trichanda Multiple Campus. It was followed by a lecture on Hydrological Study of a Probable Glacier Lake Outburst Flood (GLOF) in Tama Koshi Basin by Dr. N. Shakya. Mr. A. Pokharel, Deputy Director General, Department of Hydrology and Meteorology gave information on present level of study and future study perspectives of the Tsho-Rolpa Glacier Lake. Later on Mr. B. Rana, Geologist threw light on Glaciological aspects of Tsho-Rolpa Glacier Lake.

Similarly, Mr. S.N. Poudyal, Superintendent Engineer, Water and Energy Commission Secretariat (ECS) presented his views on Glacial Lake and possible effects of Tsho-Rolpa Glacier, Lake outburst Flood. All the lectures were followed by detail discussions.

At the end of the workshop Dr. Binayak Bhadra, the Chairman of the Technical Session put his remarks and Dr. B.N. Upreti, President of Nepal Geological Society on behalf of the organisers expressed vote of thanks to the participants and other concerned organisations.

In the year 1997/98 a series of geoscientific

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talk programs were organised on various topics by distinguished professors and researchers.

The first lecture on the series was "Geochemistry of the Modern and Ancient Sediments". The talk was delivered by Dr. Christian France-Lanord, Research Scientist, CRPG, CNRS, France in the auditorium of Department of Mines and Geology, Lainchaur on 6 May 1997. It was attended by the members of NGS and other interested persons from various organisations.

Similarly, Nepal Geological Society has organised a talk program on "Tunnelling in Heterogeneous and Weak Rock Masses: the Metro of Athens Case". The talk was delivered by Dr. Paul G. Marinos, Professor, National Technical University of Athens, Greece and the President of the International Association of Engineering Geologists and the Environment (IAEG) in the seminar hall of Water Induced Disaster Prevention Technical Centre (DPTC) on 9 January 1998. The lecture was very interesting and informative to the geotechnical and structural engineers. It was attended by over 100 professionals from the government and non-government organisations, universities, engineering colleges and consultancy firms.

Similar talk program was also organised by Nepal Geological Society on Excavation, Rock Support and Grouting of Highly Jointed and at Places loose Rock; Power Caverns IV - Philippines. The talk was delivered by Dr. K. Schetelig, Professor, Department of Engineering Geology and Hydrogeology, Aachen University of Technology, Germany in the auditorium of Department of Mines and Geology, Lainchaur on 17 March 1998. It was attended by geotechnical engineers, geologists, structure engineers and other professionals from various organisations and Tribhuvan University.

For the first time NGS did a consultancy work with UNDP/Disaster Management Secretariat, Kathmandu to prepare a "Comprehensive Database on Disaster Management Capabilities in Nepal." On behalf of Nepal Geological Society, two of its members Mr. K.P. Kaphle and Mr. M. Nakarmi prepared the report and submitted to NGS/UNDP-DMS in time. This report will be kept in Home Page

by UNDP-DMS. This marvelous work has brought the Society in light to International Community. A summary of this report was presented by Mr. K.P. Kaphle in IDNDR-Day meeting cum seminar on 6 October 1997.

A delegation led by Dr. B.N. Upreti, the President of NGS, and other members Dr. C.K. Sharma, Mr. G.S. Thapa, Mr. Y.L. Vaidya, Mr. A.M. Dixit, Mr. D.B. Thapa, Mr. K.D. Bhattarai and Mr. D.N. Subedi met Mr. Keshab Badal, Hon. Minister, Ministry of Industry and handed over a request letter to him for leasing a piece of land in the premise of DMG to NGS for the construction of Geoscience library and auditorium.

Another delegation led by Dr. B.N. Upreti and some of its members Mr. K.P. Kaphle, Mr. J.N. Shrestha, Mr. D.N. Subedi met Mr. Bharati Sharma, Director General, Department of Roads and submitted a request letter to him to create few place for geoscientists in Department of Roads.

NGS successfully organized a three-day Second Nepal Geological Congress on 11-13 Nov. 1997 in the auditorium of Nepal Administrative Staff College Premises in Lalitpur. The Congress was participated by over 250 participants from 11 countries (Nepal, India, Pakistan, Bangladesh, Japan, China, Germany, Austria, France, USA and Canada). The inaugural session of the congress was inaugurated by the chief guest Rt. Hon. Beni Bahadur Karki, Chairman, Upper House and chaired by Dr. Bhola Nath Chalise, Secretary, Ministry of Industry. In this occasion Nepal Geological Society has awarded the Honourary Membership to Mr. Puspa Bhakta Malla, a seniormost geoscientist who has devoted his time for geoscientific research and establishment of mineral based industries in Nepal. In this congress 70 research papers on various field of geoscience were presented. In the concluding session representatives of Pakistan, India, Bangladesh, Japan and Germany expressed their feelings about the congress. In the same session while presenting his concluding remarks Dr. B.N. Upreti proposed to hold HKT International Workshop in Kathmandu Nepal on the occasion of 25th Anniversary of NGS in 2004.

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नेपाल भौगर्भिक समाजको अठारौं वार्षिक साधारण सभा

सेप्टेम्बर १२, १९९७, काठमाडौं, नेपाल

नेपाल भौगर्भिक समाजको अठारौं वार्षिक साधारण सभा भाद्र २७, २०५४ (१२ सेप्टेम्बर, १९९७) का दिन समाजका अध्यक्ष डा. विशालनाथ उप्रेतीको अध्यक्षतामा होटल क्लासिकको सभाकक्षमा सुसम्पन्न भयो । उक्त सभामा समाजका सचिव

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Annual Report by Mr. D. N. Subedi, Secretary, Nepal Geological Society

Respected Chairman

Dear Fellow Members of the Society

Ladies and Gentlemen

It is a great pleasure for me to welcome you all to the 18th annual general body meeting of the Nepal Geological Society. One year has already been passed since we took the responsibility of the prestigious office of the Nepal Geological Society.

As you all know the Nepal Geological Society has made significant achievements during the past years. It is indeed a happy moment for me to be here standing in front of you, distinguished members, to present the annual report of the society. Please allow me to present the activities of the society conducted in the last one year. During the last one year we have been keeping our effort to the extent possible to enhance the activities of the society and fulfill its objectives.

As you know the tradition of biennial function of the Society was continued by organising a Biennial dinner at Hotel Himalayan on August 30th, 1996 in joint cooperation with the previous 8th Executive Committee. In this Biennial function "भूकम्पको बिनाशबाट कसरी जोगिने ?" Booklet was released which was published by the Nepal Geological Society.

We have continued the regular programme to observe the International Decade for Natural Disaster Reduction (IDNDR) Day by organising a day-long National Meeting cum Seminar on 9th October, 1996. Last year's theme was "understanding our physical environment: key to natural disaster reduction" under the general theme of UN "Cities at Risk".

In the day long meeting 11 Scientific papers were presented. A resolution was also adopted by the participants and the resolution

was sent to all the related national and international organisation, and agencies and His Majesty's Government of Nepal.

Also, in connection with the international Decade for Natural Disaster Reduction (IDNDR) a Workshop cum Training on Natural Disaster Preparedness was organized in collaboration with Lutheran World Service/Nepal. Disaster Preparedness Project on 27th November 1996. The training was organized for the High School teachers from Kathmandu, Bhaktapur, and Lalitpur districts. There were 30 participants from Public High Schools, 6 from Private High Schools, 8 officers from Ministry of Education, and 16 from Various National and International Organisations.

This year also we are going to organise a Meeting cum Seminar on the IDNDR Day on 6th October, 1997. The theme for this year is "Natural Disaster Reduction in Nepal: Experiences and Challenges" under the general theme of UN "Too much water, too little: leading cause of natural disasters". We invite all our members to actively participate in the meeting.

Regarding the publication, the Journal and News Bulletin of Nepal Geological Society is being published regularly. Printing and distribution of volume 13 was completed in time. The proceedings of the first Nepal Geological Congress was published as a special issue of the Journal of Nepal Geological Society (Volume 14). The journal is already being distributed. Volume 15 has also just come out of press. We request to all our members to buy the journals and help towards making our journal sustainable.

I would like to request here to all the members, to subscribe the Journal of Nepal Geological Society, by depositing in advance Rs. 200/- to Rs. 500/- for members of SAARC

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countries and US\$ 50 to 100 for other members. This will help to circulate the Journal to all the members in time and also the Society will benefit from the subscription deposit. The subscribers will promptly receive the Journal at their address along with the statement of account. The Journal will be sent as long as the deposit will cover the cost.

As per the decision made by the General Body, during the 17th Annual General Body Meeting, regarding the Rules and Regulations for election of the executive members of the Nepal Geological Society, the Rules and Regulation Sub-Committee has prepared draft proposal and is going to be discussed for necessary action in this 18th General body meeting.

Dear members, we have already known from the last year's report that the decision on our request to acquire land for the construction of the Society's Office/Library Building at the premises of Department of Mines and Geology was not in our favor. This matter has been again taken up, and with the favourable recommendations of the Department of Mines and Geology, the file has again reached the Ministry of Industry. We have been approaching to the respective authorities in the ministry for an early and favourable decision. Most recently, a delegation from the Society also met the Honourable Minister of Industry and appraised about the matter. In this regard, the society is very much thankful to the Director General of the Department of Mines and Geology Mr Gopal Singh Thapa for his strong support and recommendations for reforwarding the necessary documents to the Ministry.

This year we have been able to organised two Scientific Talk Programs. The first lecture was on "Multiphase Tectonic in the Indus Suture Zone in Ladakh" delivered by Dr. G. Fuchs (Austria) on Sept. 13, 1996. The other one was on the erosion and sedimentation rate of the Himalaya by Christian France-lanord (France).

One-day Scientific workshop had been conducted in Russian culture center in collaboration with Nepal Engineers Association on "Tsho Rolpa" Glacial Lake. More than 200 Geoscientists and Engineers and high level officers of His Majesty's Government had participated the workshop.

The Second Nepal Geological Congress is going to be organized on Nov. 11-13, 1997. To complete the Second Nepal Geological Congress smoothly, an organizing committee has been formed. We have already circulated the first and second circular to all the National and International Geoscientific organization and the members of Nepal Geological Society. We have already received 105 abstracts from 8 countries. The third circular will be sent very shortly.

The representation of Nepal Geological Society is being continued in various workshops, seminars and meetings organised by different Ministries of His Majesty's Government and various national and international organizations. This year, NGS has represented in the following meetings:

Workshop on "Environmental impact on water resources evaluation guideline" jointly organised by Ministry of Population and Environment and Ministry of Water Resources.

Workshop on "Management of Disaster and Civil Emergency" organised by Nepal Police Project, National Police Academy.

Meetings on amendment of civil servant law 2049 jointly organised by Nepal Engineers Association and other professional associations and societies.

Meeting on Environmental Protection Law 2053 organised by Ministry of Population and environment.

"Public Interaction on Medium Hydropower Study Project organised by Nepal Electricity Authority.

Meeting on Sand Mining in Kathmandu Valley organised by Ministry of Population and Environment Working Group.

Meeting organised by National Society for Earthquake Technology.

Dear Members, the strengthening of NGS library is a matter of concern to all of us. In this respect, we have been able to make only little progress. We are receiving journals from the exchange program from various organisation such as National Center of Excellence in Geology University of Peshawar, Pakistan, Wadia Institute of Himalayan Geology, India, BGR Germany, Institute of Geology, Punjab University, Pakistan and British Geological Survey etc.

We are very happy to inform you that the society has gained a considerable strength in its

membership. The membership status as of 12th September, 1997 (27th Bhadra, 2054) is as follows:

Total members: 462, out of which

Full members: 399 (life members: 265)

Associate members: 63

The issue of employment of geologists in various organisations such as Ministry of Population and Environment, Soil Conservation Department, Department of Roads, etc. has been raised in the General Body meeting time and again. For the fulfilment of these objectives, we have formed a Sub-Committee to approach the respective departments and ministries. This Sub-Committee is actively working to achieve its objectives. Recently, the Sub-Committee had a meeting with the Director General of Department of Roads and had a very fruitful discussion. Similarly we have plans to have meetings with other related departments.

We are also happy to inform you that the Nepal Geological Society has started consulting services from this year. The first work that we have received from UNDP on "Preparation of a Comprehensive Data Base on Natural Disaster Management Capabilities in Nepal." From this work NGS will not only earn about Rs. 60,000/- as consulting fee but also its credibility in the national and international organisations will greatly enhance.

Dear members, whatever we have been able to do during the last one year it is due to your help, support and advice. On behalf of the executive committee and myself I would like to offer our sincere thanks to all of you for your active cooperation and continued support all the times. Various governmental and non-governmental agencies have provided technical and financial support to the society. The 9th executive committee would like to extend heartfelt thanks to those organisations and agencies and hope that such cooperation will be continued in future. Particularly, I would like to mention here the following organisations.

- Department of Mines and Geology
- Petroleum Exploration Promotion Project
- Ground Water Resources Development Project
- Department of Irrigation
- Central Department of Geology, Kirtipur Campus, Tribhuvan University
- Department of Geology, Tri-Chandra

Campus, Tribhuvan University

- Water Induced Disaster Prevention Technical Centre (DPTC)
- United Nations Development Program (UNDP)
- Royal Nepal Academy of Science and Technology (RONAST)
- Ministry of Home
- International Centre for Integrated Mountain Development (ICIMOD)
- Lutheran World Service
- Environmental Geology Project (DMG/BGR)
- Nepal Electricity Authority
- Nepal Electricity Development Center

We would also like to extend our sincere thanks to Mr. Krishna Murari Amatya, member of our society for his continued support and help towards strengthening the financial status of the society by sale of maps, etc.

We would also like to express our sincere thanks to the Department of Mines and Geology for providing a separate room for the office of the Society. In this regard, we are specially thankful to Mr. Gopal Singh Thapa Director General of DMG for his support in providing the room.

We are also very much thankful to Godavari Marble Industries Pvt. Ltd. who has agreed to provide Rs. 15,000 for each publication of the Journal of Nepal Geological Society on a regular basis. It has already provided the fund to publish the Volume 15.

We are also thankful to Mr. Mukunda Raj Poudel, Executive Member, Nepal Geological Society who worked as an Acting Treasurer of the society so efficiently and sincerely that without whose efforts we could not have done much.

While working, there may have been shortcomings and weakness from our part. For this, I would like to take this opportunity to extend our sincere apology on behalf of the Executive Committee. Also at this moment, we would like to renew our request once again for the continuation of your support, advice and cooperation as well as to point out our weaknesses. We sincerely hope that we will be continuously guided by the respected members of the Society in future.

Thank you.

का.वा. कोषाध्यक्ष श्री मुकुन्दराज पौडेलले प्रस्तुत गर्नुभएको २०५३/५४को आर्थिक विवरण

श्रीमान् सभापति महोदय,
नेपाल भौगर्भिक समाजका सम्मानित सदस्य
श्री चन्द्रकान्त शर्माज्यू,
आदरणीय पूर्व अध्यक्षज्यूहरू एवं नवौं का.का. समितिका
सदस्य साथीहरू
एवं उपस्थित सम्पूर्ण सदस्य साथीहरू

सर्वप्रथम यस भौगर्भिक समाजको कार्यवाहक
कोषाध्यक्षको पदमा रही आर्थिक क्षेत्रमा समाजको प्रगतिको
लागि केही योगदान दिने मौका प्रदान गर्नुभएकोमा यस
समाजका सम्पूर्ण सदस्य महानुभावहरू तथा नवौं
कार्यकारिणी समितिलाई धन्यवाद दिन चाहन्छु ।

आज यस समाजको अठारौं वार्षिक साधारण सभामा
समाजको २०५३/०५४ को आर्थिक विवरण पेश गर्न
उपस्थित भएको छु । समाजको नवौं कार्यकारिणीमा निर्वाचित
कोषाध्यक्ष अध्ययनको लागि विदेश जानुभएकोले सो स्थानमा
मलाई नेपाल भौगर्भिक समाजको नवौं कार्यकारिणी समितिले
२०५३ साल भाद्र २२ गतेदेखि कार्यवाहक कोषाध्यक्ष पदमा
राखी कोषाध्यक्षको कार्यभार सुम्पिएको कुरा सबैमा विदितै
छ ।

आदरणीय साथीहरू, दिन प्रतिदिन यस समाजको आर्थिक
कारोवार बढ्दै जानु र साथै आर्थिक कारोवार संचालनको
नियमहरू अनुरूप त्यसको सम्पूर्ण ज्ञानको कमिले गर्दा
आर्थिक कारोवार संचालन गर्न कठिनाई पर्नु स्वभाविकै
देखिन्छ तर पनि मैले आफ्नो बुद्धि र विवेकले भ्याएसम्म
हिसावलाई पारदर्शी रूपमा राख्न प्रयास गरेको छु ।

आर्थिक वर्ष २०५३/०५४ को आर्थिक कारोवारको
सम्पूर्ण कागजात लेखा परिक्षकसँग लेखा परिक्षण गराई
त्यसको प्रतिवेदन पनि यस सभामा पेश गरेको छु । यहाँ म
संक्षिप्त विवरण पेश गर्दछु ।

१. २०५३ साल श्रावण ३२ गतेसम्ममा यस कार्यकारिणी
समितिलाई प्राप्त भएको २०५२/०५३ को हिसाब-

| | |
|--------------|-----------------|
| बैंक मौज्दात | रु. ३,८२,६०८.२६ |
| नगद | रु. १,७१७.१९ |
| जम्मा | रु. ३,८४,३२५.२५ |

२. २०५३/०५४ को कार्यकालमा यस समाजबाट भएको
खर्च र आम्दानी

| | |
|---------------|-----------------|
| जम्मा आम्दानी | रु. ८,६९,१८३.५८ |
| जम्मा खर्च | रु. ५,९८,०३६.८४ |

३. मुख्य मुख्य शीर्षकमा भएको आम्दानी

(क) पत्रिका बिक्री:-

| | |
|------------------------------------|---------------|
| रु. ४१,९२२.०० + US\$ १२५ = ७०९३.७५ | |
| जम्मा | रु. ४९,०१५.७५ |

- Subscription

| | |
|----------------------|---------------|
| - नेपाली सदस्यबाट | रु. १४,५००.०० |
| - विदेशी सदस्यहरूबाट | रु. ५९,८७१.२५ |
| जम्मा | रु. ७४,३७१.२५ |

(ख) भौगर्भिक नक्सा

रु. ३६,४२७.००

(ग) बुलेटिनमा विज्ञापन

रु. २३,०८०.००

(घ) सदस्यहरूबाट योगदान

रु. २२,६६४.००

(ङ) अन्य योगदान

(१) प्रकाशनको लागि

| | |
|----------|-----------------|
| Lutheran | रु. १,२२,२३५.०० |
| ICIMOD | रु. ५६,७५०.०० |
| RONAST | रु. २०,०००.०० |
| जम्मा | रु. २,३३,९८५.०० |

(२) 2nd Nepal Geological Congress

| | |
|------------------|-----------------|
| Butwal Power Co. | रु. २०,०००.०० |
| TAHAL Consult GW | रु. ४५,०००.०० |
| SMEC | रु. २८,३५०.०० |
| GDC Project | रु. ४०,०००.०० |
| East Consult | रु. १७,०२५.०० |
| जम्मा | रु. १,५०,३७५.०० |

४. २०५४/४/३२ गतेसम्मको हिसाब हेर्दा-

| | |
|--------------|---------------------------------|
| २०५३/०५४ | २०५२/०५३ |
| बैंक मौज्दात | रु. ६,५१,३२६.६० रु. ३,८२,६०८.२६ |
| नगद | रु. ४,१४६.०० रु. १,७१७.१९ |
| जम्मा | रु. ६,५५,४७२.६९ रु. ३,८४,३२५.२५ |

५. तसर्थ यो एक वर्षको कार्यकालमा सम्पूर्ण खर्च कटाई
जम्मा रु. २,७१,१४६.७४ समाजको रकममा वृद्धि
भएको स्पष्ट हुन्छ ।

Best Wishes
and
Hearty Felicitation
on the
Auspicious Occasion
of
Happy New Year 2055

BUTWAL POWER COMPANY LIMITED (BPC)

A Pioneer Private Sector Hydropower Developer,
Promoter of local Institutional capability and manpower building
through training and technology transfer
emphasising on the use of Appropriate Technology
& Environment friendly development

- Field of Activities:** Build, own and operate hydropower plant by maximizing use of local capability & Institution building.
- Accomplishments:** Tinau - 1 MW, Andhikhola - 5.1 MW, Jhimruk - 12 MW
- Ongoing Activities:** Khimti Hydropower Project (60 MW) as sponsor and support through engineering design, project management and administration services.

Rural Electrification: Syangja and Pyuthan district using cut-out system.
- Other Activities:** Environmental and Community Development Services and Consulting Services e.g. feasibility studies, model studies, geotechnical studies etc.
- Ownership, Operation and Management:** Andhi Khola and Jhimruk power plants.
- Address:** Pulchowk, Lalitpur, P.O. Box 11728,
Tel.: 521824, 535595, 525732
Fax: 527898

Auditor's Financial Report 2053-054

The Members
Nepal Geological Society
Kathmandu.

Gentlemen,

I have audited the attached Receipt & Payment Account for the year ended 32nd Shrawan 2054 and reports as follows:

1. I have got all the information and explanations which are required for the purpose of audit.
2. Proper books as required are maintained according to Company's Law.
3. The attached Receipt & Payment Account and Income & Expenditure Account are drawn properly up in accordance with records which are made available to me.
4. According to the information given to me the attached Income & Expenditure Accounts prepared for the year ended 32nd Shrawan 2054 exhibit true and fair view.

Sd.

(Babu Raja Bajracharya)

Registered Auditor

Date: 15th Bhadra 2054

With Best Compliments
from

EastConsult

A Premier Consulting Organization in Nepal

Sister Concerns

East Soil Lab.
East Drilling Co.
East Surveying Co.

P.O. Box 1192, Lazimpat, Kathmandu, Nepal
Tel: 413 267, 412 062, 428 496
Fax: 977-1-417895
Email: sp@eastco.wlink.com.np

Engineers

Social Scientists

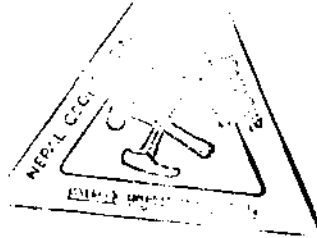
Economists

Development Planners

NEPAL GEOLOGICAL SOCIETY

RECEIPT AND PAYMENT ACCOUNT For the year ended 32 Srawan 2054

| Receipt | Amount | Payment | Amount |
|---|--------------|--------------------------------|--------------|
| To cash | 1,717.19 | By advertisement | 4,492.00 |
| To bank | 382,608.26 | By advance A/c | 68,600.00 |
| To contribution (other) | 364,360.00 | By auditor fee | 4,000.00 |
| To contribution (member) | 22,664.00 | By catering service | 20,000.00 |
| To advertisement | 23,080.00 | By computer service | 6,200.00 |
| To interest rec. | 15,443.21 | By fuel | 1,026.00 |
| To interest rec. (dollar) 346.35 (Bank + NCCSC) | 19,655.37 | By furniture | 7,000.00 |
| To life member fee | 13,300.00 | By hotel bill | 80,235.65 |
| To L.M.F (dollar) 200 x 56.75 = | 11,350.00 | By miscellaneous | 5,893.00 |
| To associate member fee | 900.00 | By photocopy | 32,575.50 |
| To ordinary member fee | 6,986.00 | By postage and telegram | 15,747.00 |
| To registration fee | 5,119.00 | By printing and press | 262,226.00 |
| To map sale | 36,427.00 | By refreshment | 1,499.00 |
| To journal sale | 56,422.00 | By remuneration and salary | 15,350.00 |
| To journal sale (dollar) 1182 x 56.75 | 67,078.50 | By rent | 11,900.00 |
| To workshop (IDNDR) | 67,399.00 | By stationary | 10,587.50 |
| To U.N.D.P. project | 100,000.00 | By taxi fare | 700.00 |
| To T. T. Program | 50,000.00 | By tax on interest | 155.19 |
| To miscellaneous Income | 9,000.00 | By IDNDR | 40,925.00 |
| | | By tele and fax | 5,425.00 |
| | | By add cheque (2000 + 1500) | 3,500.00 |
| | | By balance | |
| | | - Nepal Bank, Bhotahiti | 9,949.27 |
| | | - Nepal Bank, Fixed A/c | 37,000.00 |
| | | - Nepal Bank Saving A/c | 6,765.23 |
| | | - Nabil Bank Saving 8201 | 200,881.50 |
| | | - Nabil Bank Fixed A/c | 29,000.00 |
| | | - Nabil Bank Dollar | 310,890.69 |
| | | - Agriculture Dev. Bank Saving | 19,862.00 |
| | | - Agriculture Dev. Bank Fixed | 37,000.00 |
| | | - Cash in hand | 4,124.00 |
| | 1,253,509.53 | | 1,253,509.53 |



Atkande Pandey
Atkande Pandey
Treasurer

Prasanna Kumar
Prasanna Kumar
President

Dr. Subedi
Dr. Subedi
Secretary

Subodh Chandra
Subodh Chandra
Auditor

NEPAL GEOLOGICAL SOCIETY

INCOME AND EXPENDITURE ACCOUNT

For the year ended 31 Srawan 2054

| Expenditure | Amount | Income | Amount |
|---------------------------------|------------|---|------------|
| To advertisement | 4,492.00 | By contribution (other) | 364,360.00 |
| To advance A/c | 68,600.00 | By contribution (member) | 22,664.00 |
| To auditor fee | 4,000.00 | By contribution \$ | |
| To catering service | 20,000.00 | By advertisement | 23,080.00 |
| To computer service | 6,200.00 | By int. received | 15,443.21 |
| To fuel | 1,026.00 | By int. rec. (dollar) 346.35 x 56.70 (one + nine) | 19,655.37 |
| To furniture | 7,000.00 | By life member fee | 13,300.00 |
| To hotel bill | 80,235.65 | By life member fee (\$) 200.00 | 11,350.00 |
| Miscellaneous | 5,893.00 | By associate member fee | 900.00 |
| To photocopy | 32,575.50 | By ordinary member fee | 6,986.00 |
| To postage & telegram | 15,747.00 | By registration fee | 5,119.00 |
| To Printing & press | 262,226.00 | By map sale | 36,427.00 |
| To refreshment | 1,499.00 | By journal sale | 56,422.00 |
| To remuneration | 15,350.00 | By journal sale (\$) | 67,078.00 |
| To rent | 11,900.00 | By workshop (IDNDR) | 67,399.00 |
| To stationery | 10,587.50 | By U.N.D.P. project | 100,000.00 |
| To taxi fare | 700.00 | By T. T. Program | 50,000.00 |
| To tax on interest | 155.19 | By miscellaneous | 9,000.00 |
| To telex & fax | 5,425.00 | | |
| To ID NDR | 40,925.00 | | |
| To add cheque (2000+1500) | 3,500.00 | | |
| Surplus Income over expenditure | 598,036.84 | | |
| | 271,146.74 | | |
| | 869,183.58 | | 869,183.58 |

M. K. Paudyal
Act. Treasurer

A. S. Sharma
President

P. B. S. S.
Secretary

S. B. S. S.
Auditor

WATER RESOURCES CONSULT (P.) LTD.

Babar Mahal, Kathmandu, Telephone No.: 251518

EXPERIENCE

- Study of landslides and debris flows in the Kamala River Watershed, Eastern Nepal.
- Sector programme support identification on energy sector for DANIDA.
- Hazard mapping of the Lothar, East Rapti River and Marin Khola watershed and also watershed of Agra, Belkhu and Malekhu Khola in Dhading District.
- Landslide study, core drilling and installation of monitoring equipment for DPTC.
- Feasibility studies of small hydro-power projects at many different places, e.g., Okhaldhunga-Rumjatar, Ramechhap, Sindhulimarhi and Udaypur Gaighat-Bokse for Small Hydel Development Board.
- Feasibility study of Mulghat Hydro-Electric Project (68 MW) in collaboration with Electrowatt Engineering Services, Switzerland.
- Detailed feasibility studies of mini-micro hydro power project in Kagbeni-Muktinath in Mustang district and Pakhapani in Myagdi district.
- Detailed design of small hydroelectric projects in Rawa (Khotang) and Dharam Khola (Baglung).
- Site investigation for feasibility study of Puwa Khola Hydroelectric project (6,200 kW) in association with Chuo Kaihatsu Corporation for JICA.
- Consultancy/advisory services in project preparation and design, in acquiring the development license, in preparation and negotiation of power project agreement for private sector financing such as Modi Khola HEP (14 MW) and Upper Bhote Koshi HEP (335 MW).
- Feasibility study of the proposed Naugarh Gad HEP (2 MW) in Darchula District.

SERVICE

The services offered cover all phases of project cycle i.e. from identification through feasibility, planning and designing to implementation and management services including training. Some of the fields covered by Water Resources Consults P. Ltd. (WRC)'s experienced professional staff are:

- Topographical survey, water resources, environment, and watershed management.
- Design of small/mini-micro hydroelectric projects.
- Feasibility study of small and medium hydroelectric projects and detailed engineering design of small hydroelectric projects.
- Socio-economic studies and rural development.
- Project management and hydraulic engineering services and technical services in operation and maintenance of hydropower stations, transmission lines and sub-stations.
- Management services, human resource development, revenue and store management related to the hydro electric project and socio-economic project, as well.
- Manpower training services in electricity generation, supply and management.
- Study of landslides, hazard map preparation, core drilling and slope stabilization and advisory services for hydro electric project to the various private parties.
- Water Resources Consult (P.) Ltd. has been providing consulting and advisory services to various development projects of government as well as semi-governmental organization.

अठारौं वार्षिक साधारण सभामा भएका छलफल तथा निर्णयहरू

२०५४ भाद्र २७ (तदनुसार १२ सेप्टेम्बर १९९७) का दिन अपरान्ह न्यूरोड, काठमाडौंस्थित होटल क्लासिकको सभाकक्षमा बसेको यस समाजको अठारौं वार्षिक साधारण सभामा समाजका अध्यक्ष डा. विशालनाथ उप्रेतीले स्वागत भाषण र आफ्ना मन्तव्य प्रस्तुत गर्नुभएपछि समाजका सचिव श्री देवीनाथ सुवेदीले समाजको अठारौं वार्षिक प्रतिवेदन र कार्यवाहक कोषाध्यक्ष श्री मुकुन्दराज पौडेलले अडिटरको वार्षिक प्रतिवेदन (आय-व्ययको विस्तृत विवरण) प्रस्तुत गर्नुभएको थियो । तत्पश्चात् उक्त सभामा समाजका पूर्व अध्यक्ष एवं Rules and Regulations Sub-Committee का संयोजक श्री अच्युतानन्द भण्डारीले प्रस्तावित निर्वाचन नियमावलीका विभिन्न बुँदामा प्रकाश पार्नुभएको थियो ।

उक्त अवसरमा का.का.स. मा रिक्त रहेका कोषाध्यक्ष पद एक र सदस्य पद एकमा मनोनयन गर्नुपर्ने भएकोले उक्त साधारण सभामा सर्वसम्मतिबाट यस समाजका सदस्यहरू श्री मुकुन्दराज पौडेललाई बाँकी अवधिको लागि समाजको का.का.स.को कोषाध्यक्ष पदमा र श्री माधव आचार्यलाई का.का.स. को सदस्य पदमा मनोनयन गरियो ।

नेपाल भौगर्भिक समाजको विधान अनुसार का.का.स. को बैठकले यस वर्ष (१९९७ मा) नेपालका भू-विज्ञान क्षेत्रमा विशेष योगदान पुऱ्याउने अग्रज भू-वैज्ञानिकलाई यस समाजले सम्मानित सदस्य प्रदान गरि सम्मान गर्ने निर्णय गरि नाम सिफारिश गर्न डा. रमेशप्रसाद बस्यालको संयोजकत्वमा एक सिफारिश कमिटी बनाएको र सो कमिटीले यो वर्ष उक्त सम्मान नेपालका अग्रज एवं वयोवृद्ध भू-वैज्ञानिक श्री पुष्पभक्त मल्लज्यूलाई प्रदान गर्न सिफारिश गरे अनुसार यस साधारण सभामा निर्णयार्थ पेश हुँदा सर्वसम्मतिबाट निज मल्ललाई यही आउँदो दोस्रो नेपाल जियोलोजिकल कांग्रेस (Second Nepal Geological Congress) आयोजना गरेका बेला यस समाजको सम्मानित सदस्यता प्रदान गरी सम्मान गर्ने निर्णय भयो । उक्त अवसर मा सम्मानित सदस्य डा. चन्द्रकान्त शर्मा, अध्यक्ष डा. विशालनाथ उप्रेती र पूर्व अध्यक्ष श्री आमोदमणि दीक्षितले श्री मल्लको योगदान बारेमा प्रकाश पार्नुभएको थियो ।

समाजले सम्मानित गर्ने व्यक्तिको छनौट गर्दा धेरै कुराको गहन अध्ययन गरी राम्ररी विचार पुऱ्याएर गर्नुपर्ने हुँदा एक स्थायी कमिटी (Permanent Nominating Body/Committee) बनाउन पर्छ कि भन्ने प्रस्ताव डा. विशालनाथ उप्रेतीले राख्नुभएकोमा श्री कल्याणदेव

भट्टराईले राख्नुपर्छ भन्ने मनसाय व्यक्त गर्नुभयो भने श्री महेश नकर्मिले यस प्रकारको कमिटीमा ५ जना हुनुपर्छ र जसमध्ये एक जना सम्मानित सदस्य, एकजना भू.पू. अध्यक्ष, एक जना Advisory Committee को सदस्य, एक जना Scientific Committee को सदस्यबाट र समाजका अध्यक्ष भन्ने राय व्यक्त गर्नुभएकोमा भू.पू. अध्यक्ष श्री कृष्णप्रसाद काफ्लेले त्यस्तो स्थायी निकायको आवश्यकता नपर्ने कार्यकारिणी समितिले केही समयको लागि त्यस्तो अस्थायी निकाय बनाउन सक्ने र सो निकायले आवश्यकता अनुसार Advisory Committee र Scientific Committee तथा समाजका पूर्व अध्यक्षहरूको राय सल्लाह लिएर केही विशेष Criteria को आधारमा व्यक्तिको नाम सिफारिश गरि का.का.स. मा पेश गर्ने र का.का.स.ले साधारण सभामा प्रस्ताव राखि पास गराउन राम्रो हुने कुरा प्रस्तुत गर्नुभयो र सो प्रस्तावलाई श्री वासुदेव खरेल र डा. मेघराज धितालले समर्थन गर्नुभयो । यसरी नै श्री अच्युतानन्द भण्डारी र श्री आमोदमणि दीक्षितले पनि सोको लागि स्थायी निकायको आवश्यकता नपर्ने र यदि आवश्यक परेको खण्डमा का.का.स. ले नै निर्णय गरि सोही अनुसार गर्ने कुरा व्यक्त गरेपछि सर्वसम्मतिबाट सोको लागि स्थायी समिति नबनाउने निर्णय भयो । उक्त अवसरमा डा. मेघराज धितालले श्री पुष्पभक्त मल्लका प्रकाशित तथा अप्रकाशित लेख तथा रिपोर्टहरू संकलन गरी छाप्न राम्रो हुने मन्तव्य व्यक्त गर्नुभएको थियो ।

नेपाल भौगर्भिक समाजले आधिकारिक कामका लागि प्रयोगमा ल्याई आएको छाप त्रिभुजाकार, ठूलो र भद्दा भएकोले यसलाई बदली गरी सानो गोलो रूपको नयाँ छाप बनाउन कस्तो होला ? भनि डा. विशालनाथ उप्रेतीले राख्नुभएको प्रस्तावमा छलफल हुँदा उक्त छापलाई बदल्न नसकिने तर उस्तै आकारमा अलि सानो पार्न सकिन्छ भन्ने कुरा सर्वसम्मतिबाट पास भयो ।

हालको का.का.स. को पदावधि कति वर्षको हो भनेर श्री कृष्णमुरारी अमात्यले उठाउनुभएको प्रश्नको जवाफमा अध्यक्ष डा. विशालनाथ उप्रेतीले यो का.का.स. पुरानै विधान अनुसार चुनिई आएको र नयाँ संशोधित विधान यस समाजको सत्रौं साधारण सभाबाट पास भए पनि आधिकारिक दर्ता गर्ने प्रक्रिया अझै पूरा नभइसकेकोले लागू नभएको अवस्थामा यस का.का.स. को कार्यकाल दुई वर्षको नै हुने कुरा स्पष्ट पार्नुभयो ।

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International Decade for Natural Disaster Reduction IDNDR-Day, October 6, 1997

**National Meeting cum Seminar on
"Natural Disaster Reduction in Nepal Experiences and Challenges"
under the general theme proposed by UN for this year "Water Too
Much Too Little: Leading Cause of Natural Disasters"**

The Nepal Geological Society as in the past has organised a one-day National Meeting cum Seminar on "Natural Disaster Reduction in Nepal Experiences and Challenges" in Kathmandu in collaboration with National Committee for IDNDR Nepal and UNDP/Nepal. The United Nations has declared the 1991-2000 as the International Decade for Natural Disaster Reduction. Second Wednesday of October is the IDNDR-Day to observe. The theme of IDNDR-Day for this year given by UN is "Water Too Much Too Little: Leading Cause of Natural Disaster". The Nepal Geological Society has responded UN declaration since 1991 by organising one-day National Meeting cum Seminar every year and this is the continuity of this tradition.

The Inaugural Session was chaired by Mr. Keshav Sthapit, Mayor, Kathmandu Metropolitan City. Mr. R. R. Pokharel, Secretary, Ministry of Home was the chief guest.

Dr. B.N. Upreti, President, Nepal Geological Society, delivered the welcome speech. The

Chief Guest, Mr. R. R. Pokharel, Secretary, Ministry of Home, inaugurated the Meeting cum Seminar and addressed the gathering. Mr. A.M. Dixit, Coordinator, NGS/IDNDR Council highlighted on the IDNDR concept. The meeting was also addressed Mr. Keshav Sthapit, Mayor of Kathmandu Metropolitan City, Mr. W. Berger, Coordinator, Disaster Management Secretariat, UNDP, Nepal, Mr. N. B. Kayastha, Director General, DMG, Mr. K. S. Yogacharya, Director General, Department of Hydrology and Meteorology, Mr. Jnan Kaji Shakya, Member Secretary, IDNDR, National Committee, Nepal, Mr. Todd Stowell, Lutheran World Service and Mr. M. Poudel, Project Director DPTC. The Inaugural Session was followed by two Technical Sessions. It was attended by over 250 representatives from different national and international organisations and agencies based at Kathmandu. During this session 12 working papers on various aspects related to natural and manmade disasters were presented and discussed. Some of the speeches and abstracts of the papers are presented in this Bulletin.

**Best Wishes and Hearty Felicitations
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...SPECIALIZED WORKS OF GEOTECHNICAL WORK

Welcome Speech by Dr. B.N. Upreti, President, Nepal Geological Society.

**Honourable Chairman Mr. Keshav Sthapit,
Mayor, Kathmandu Metropolitan City
Honorable Chief Guest Mr. R.R. Pokharel,
Secretary, Ministry of Home
Special Secretary Mr. Sri Man Shrestha
Mr. William S. Berger, Coordinator, Disaster
Management Secretariat, UNDP/Nepal
IDNDR Member Secretary Mr. Jyan Kazi
Shakya
Respected Senior officials of His Majesty's
Government
Distinguished Guests
Dear Fellow Members of Nepal Geological
Society
Ladies and Gentlemen**

It gives me great pleasure to welcome you all to this meeting - cum - Seminar organised on the occasion of the IDNDR Day-1997.

Thank you very much for kindly accepting our invitation to attend this program. We are particularly thankful to the Chief Guest Mr. Pokharel and Mayor of Kathmandu Mr. Sthapit for being kind to be with us this morning.

As you all know that the UN General Assembly in 1989 declared the decade of 1990-2000 as the International Decade for Natural Disaster Reduction. It is observed every year on the second Wednesday of October. This year this day actually falls on 8th of October. As the 8th October falls within Dasain Festival Vacation, we are organising this meeting two days earlier on 6th October.

Nepal Geological Society has been observing the IDNDR-Day since the first year of the IDNDR Decade, i.e. since 1991. It has also constituted a permanent council within the Society, the NGS-IDNDR Council. We are very happy to see that now, this program has received a national focus and so many Government and Non-government organisations have been involved in this program.

Nepal Geological Society has over the years been working towards fulfilling the goals of IDNDR. In addition to the observance of this day, it has also been working in other fields. Last year, in collaboration with Lutheran World

Service/Nepal Disaster Preparedness Project and National Society for Earthquake Technology Nepal, we have published an awareness booklet on Earthquake Disaster preparedness. Again, with the financial support of Lutheran World Service, we are preparing another booklet on Landslide Hazard Mitigation. Last year in November as part of the IDNDR -Day program, in collaboration with the Lutheran World Service and Ministry of Education, NGS organised a one-day training program on natural disaster Reduction to 60 high school teachers of the Kathmandu valley. This year in November, we are planning to conduct a similar two-day program to one hundred High School teachers of the valley in collaboration with Lutheran World Service and Ministry of Education.

The Theme of IDNDR-Day for this year given by UN is **"Water too much, too little: leading cause of natural disaster"**. This theme is particularly very relevant to Nepal where the heavy rains during the monsoon is normally a leading cause of natural disaster. In addition to this theme, the society has chosen the theme for this year's seminar as **"Natural Disaster Reduction in Nepal: Experiences and Challenges"**. Indeed it is now time to look back and review what we have done in the last seven years in the field of natural disaster reduction and evaluate our experiences and identify the challenges that lie ahead.

As in the past, this meeting is followed by the technical session in which various aspects on natural disaster will be discussed. I am very happy to find that IDNDR, over the years, had definitely a very significant contribution towards building strong awareness in a wider section of the society. I do hope that the seminar will pave the way for looking at and mitigating natural disaster in a wider framework by bringing together all the concerned professionals in a common platform.

I also hope that this meeting which forms the first part of our program, will provide an over all guidance and future direction on the activities of Natural Disaster Reduction in Nepal.

Once again I extend a very warm welcome to you all and thank you very much.

Speech delivered by Mr. R. R. Pokharel, Secretary, Ministry of Home, HMG/Nepal

**Mr. Chairman,
Distinguished Guests
Mr. President of Nepal Geological Society Dr
Upreti,
Dear Colleagues**

I thank you very much for your invitation to participate in and inaugurate this important meeting. I am thankful also for the opportunity provided for sharing my views with you.

It is a pleasure to note that the IDNDR concept is developing wider roots in Nepal with each year. While the government is committed to the issues of disaster reduction in the country, it is wonderful that professional societies such as the Nepal Geological Society have been mobilising their resources in the implementation of similar tasks. I congratulate the Nepal Geological Society for making it a tradition to observe the IDNDR Day in this way. It is still more pleasant to find that your Society has established ties with other similar professional bodies to organise discussions and deliberations on pertinent issues related with aspects of disaster management in Nepal. In this context Home Ministry is glad to provide assistance and collaboration in the organisation of the Meeting.

Disaster management is an immense task in Nepal. We face several types of natural hazards. These vary from snow avalanches and GLOF in the Higher Himalayas to fire and floods in the Terai. Landslides and earthquakes are frequent. At the same time, we are also confronted with so many other problems of development that disaster preparedness appears not to have higher priority. Such condition forced the whole country in the past to focus on relief and rescue activities following a disaster. Now gradually, the country is realising that pre-disaster activities could be more cost-effective than post-disaster activities in the long run. And the pre-disaster actions could be implemented the best if they are included in the development plan of activities. This is the IDNDR Concept,

which the country tries to subscribe to.

However, it is a difficult task. Lack of resources is one of the constraints. Lack of national expertise is another constraint. At times, especially during a threat by a certain disaster such lack of experience and knowledge is felt seriously. Therefore, we all have to combine our efforts to overcome such situation as soon as possible.

The major constraint is probably our inability to address all the aspects of natural disasters comprehensively. It is now becoming clearer that an effective disaster reduction requires a synergy of a wide group of theatre actors from administrators to rescuers, seismologists to psychologists, media to professional societies. This requires a good co-ordination of efforts not only among the organisations and agencies, but also amongst individuals and specialists. This meeting is probably one of the forums to discuss such issues and identify the ways to generate the required comprehensiveness of approach.

The government's efforts in this direction is reflected in the acceptance in principle by HMG Nepal of the National Action Plan prepared by the Nepal National Committee on IDNDR. As you all know, this Committee prepared a draft of a comprehensive plan of action to be implemented by the different government and non-government agencies for natural disaster reduction in Nepal. Subsequently, the draft was reviewed by specialist working groups, who tailored the draft action plan as per the national capabilities to make it feasible economically, socially, and politically. It is hoped that the forthcoming IX Development Plan will consider aspects of the Action Plan and integrate these appropriately into the documents and programs. Please look at the National Action Plan. Please discuss this document and identify what you or your professional Society can and should do by way

of its implementation. This should be a co-ordinated and not an isolated effort. I personally consider that a professional society like yours have tremendous potentials for success in the field of awareness raising. By doing so, you can also help to establish the required co-ordination of concept as well as of action amongst the various institutions working in the various aspects of disaster management in the country.

There are many well-trained scientists and engineers in this country. It is necessary to mobilise the knowledge of these personnel in the implementation of the disaster reduction tasks. These personnel belong to various disciplines, and may be scattered in various institutions — public or private. I think it is necessary for Nepal Geological Society to enlarge its outreach and start effective dialogue with similar professional societies for bringing them also into the folds of IDNDR. This is important also because the disasters are also clever and always try to combine themselves to form complex disaster. A flood is always

combined with landslides and erosion, and earthquake-induced landslides were found to be too many during the past Udaypur Earthquake. So please learn to combine from disasters too.

I am glad to know that this IDNDR Celebration Programmes includes this ceremonial part as well as more technical parts where the scientists and technologists will discuss on their programmes, findings, and generalisations. Although I am not a specialist in geology or engineering, but I do wish to request you to remember that each and every of your activities should bear concrete fruits for the reduction of natural disaster in the country. That is what is expected of you.

I do hope that the Meeting as well as the Seminar to follow will seriously discuss related matters and come up with solutions as well as consensus on the implementation of the solutions. The government will listen to the views of the specialists and implement the pertinent recommendations.

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**Speech delivered by Jnan Kaji Shakya,
Joint Secretary, Ministry of Home, HMG/Nepal**

**Honourable Chairman,
Respectable Chief Guest,
Distinguished Participants,
Ladies and Gentlemen,**

Let me, first of all, thank the organisers of this seminar to allow me to express a few words on Nepal's activities on International Decade for Natural Disaster Reduction (IDNDR).

As you might be all aware, the UN Resolution 44/236 of 22 December 1989 has declared 1990s as the IDNDR. In pursuant with this declaration Nepal formed a National Committee on IDNDR chaired by the Hon. Home Minister in 1990. This committee set up various task forces to identify main issues on disaster management. In order to enhance the disaster management capability of the Government organisations and NGOs training programme was organized in May 1993 with the assistance and support of UNDP/DTCP/DPTC and UNHHA.

Significant efforts towards the realisation of the IDNDR objectives were however made only after the 1993 July flood and landslides, where-in too much of water in the form of heavy and incessant rain claimed the lives of some 1500 people and damaged property worth about US\$ 100 million. It was only after this unprecedented crisis that policy makers and administrators at higher level most of whom believed disaster as a post operative activity meaning thereby an activity based on rescue and relief only, painfully came to realise the other aspects of disaster. The awakening that disaster management covers disaster preparedness, mitigational activities as well as rehabilitation and reconstruction led to the restructuring of the National Committee on IDNDR on February 10, 1994. This committee

now represents wider sections of society including policy makers, professionals, academicians and social workers.

Nepal submitted "The Status of Natural Disaster Reduction in Nepal", a national report primarily based on action plans on the four aspects of disaster management to the World Conference on Natural Disaster Reduction held at Yokohama, Japan in May 1994. A high level delegation led by the then Home Minister Mr Sher Bahadur Deuba had participated in this conference.

"The Yokohama Strategy for a Safer World" has been the outcome of the conference that emphasises the need to develop a global culture of prevention. It also stresses that special attention should be given to the LDCs in support of their activities in the field of natural disaster reduction. In fact, Nepal was very much encouraged with the outcome of the World Conference. A task force was formed in 1995 to review the national report submitted to the World Conference and to reshape it in commensurate with the Yokohama strategy. The result has been the "National Action Plan on Disaster Management in Nepal, 1996" approved by His Majesty's Government.

This action plan has been widely circulated - the circulation encompassing the various implementing agencies of HMG and the donor agencies. The sectoral ministries have been assigned activities to be fulfilled in a certain time frame. Significant progress has still to be achieved in the implementation of this action plan since the sectoral ministries are finding it difficult to manage adequate resources for their activities.

One of the objectives of the IDNDR is the integration of disaster reduction measures into the development programmes. In this respect,

credit goes to the Ninth Development Plan which has now given due place to the segment on disaster management in its concept paper. A separate task force is now functioning to draft detail programmes to be included in the 9th plan. This is an optimistic indication of Nepal's commitment to fulfill the objectives of IDNDR. However, without strong support and assistance of friendly countries and donor agencies, the achievement may not be noteworthy or remarkable.

Herein I would like to quote one of the memorable guiding principles of the Yokohama Strategy, which propounds "Each country bears the primary responsibility for protecting its people, infrastructure and other national assets from the impact of natural disasters. The international community should demonstrate strong political determination to mobilise adequate and make efficient use of existing

resources, including financial, scientific and technological means, in the field of natural disaster reduction, bearing in mind the needs of the developing countries, particularly the LDCs". With this quotation, I would like to again refer to the National Action Plan, 1996. Its success, I believe, would be meaningful in celebrating the IDNDR day.

In the meantime, it may not be out of context to mention here that NSET (National Society of Earthquake Technology) has with the collaboration of Geo Hazards International, California launched KVERMP (Kathmandu Valley Earthquake Risk Management Project). No doubt, this project acts on one of the preparedness programmes on earthquake hazard as indicated in the National Action Plan. I hope such programmes will continue to grow in the future. Finally, I wish this seminar all success. Thank You.

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Vote of thanks by D.N. Subedi, Secretary, NGS

**Respected Chairman,
Honorable Chief Guest
Respected Senior Government Officials of
HMG/Nepal
Distinguished Guests and Participants
Dear Fellow Members of the Society
Ladies and Gentlemen,**

On behalf of Nepal Geological Society, I welcome you all once again to today's National Meeting cum Seminar on "Natural Disaster Reductions in Nepal: Experiences and Challenges" under the general theme proposed by United Nations for the year "Water Too Much, Too Little: Leading Cause of Natural Disasters". Since 1990 Nepal Geological Society is contributing to Natural Disaster Reduction Programmes in Nepal in close cooperation with IDNDR National Committee Nepal, DPTC and UNDP/Nepal.

The Society is very grateful to our Chief Guest, Mr. Rewati Raman Pokharel, Secretary, Ministry of Home, for giving his valuable time to this morning to inaugurate the meeting cum seminar and for the inaugural speech.

The Society would also like to express its sincere gratitude to Mr. Keshab Sthapit, Mayor, Kathmandu Metropolitan City for his address to this inaugural session.

The Society likes to extend its sincere gratitude to Mr. William Berger, Coordinator, Disaster Management Secretariat, UNDP/Nepal for being with us and the notable address and financial support for this programme and also taking over the chairmanship of this session.

The Society has always received strong cooperation and support from the IDNDR National Committee, Nepal. The Nepal Geological Society extends its sincere thanks to the IDNDR National Committee, Nepal, for all their supports and cooperations to organise today's meeting cum seminar.

Collaborative support for the organisation of today's meeting cum seminar has been provided by Disaster Prevention Technical

Centre (DPTC). The Society would like to extend its sincere acknowledgement to Mr. Madhusudan Poudel, Director, Water Induced Disaster Prevention Technical Center for collaborative support extended to the Nepal Geological Society.

Sincere thanks are also due to Mr. Todd Stowell, Project Coordinator, Disaster Preparedness Project, Lutheran World Service for being with us this morning and his address to the Inaugural Session.

The Nepal Geological Society would also like to extend its sincere gratitude to all the high officials of His Majesty's Government of Nepal, distinguished guests, journalists and other distinguished personalities for being with us in this ceremony.

The organisation of today's meeting cum seminar has been made possible by presence of you all, distinguish participants and scientists, by providing contribution of your valuable papers. The Nepal Geological Society extends its heartfelt thanks to all the distinguished participants and scientists.

The various governmental and non-governmental organisations and agencies helped the Society in various aspects in the organisation of this meeting cum seminar. Sincere thanks are due to Ministry of Home, Department of Mines and Geology, Petroleum Exploration Promotion Project and Department of Geology, Trichandra Campus for their various support extended to the Society.

Special thanks go to all our members of the Nepal Geological Society for their continuous cooperation and support in the organisation of today's meeting cum seminar.

Our sincere thanks are also due to the Russian Centre of Science and Culture for providing this venue for today's meeting.

We offer our sincere apologies for any inconveniences that may have arisen during the organisation of this programme.

Once again thank you, thank you all !

प्राकृतिक प्रकोप न्यूनीकरण विषयमा कार्यशाला गोष्ठी

काठमाडौं, मंसिर २४ गते । प्राकृतिक प्रकोप न्यूनीकरण अन्तर्राष्ट्रिय दशकको सन्दर्भमा उपत्यकाका विद्यालय शिक्षकहरूका लागि प्राकृतिक प्रकोप न्यूनीकरण विषयक दुई दिने तालीम कार्यशाला आज यहाँ प्रारम्भ भयो ।

नेपाल भौगर्भिक समाजद्वारा शिक्षा मन्त्रालय, लुथरन वर्ल्ड सर्भिस नेपाल, राष्ट्रसंघीय विकास कार्यक्रम र भूकम्प प्रविधि राष्ट्रिय समाज नेपालको सहयोगमा संचालित उक्त कार्यक्रममा उपत्यकाका ९३ विद्यालयका शिक्षक तथा शिक्षासँग सम्बन्धित अधिकारीहरूको सहभागिता छ ।

प्राकृतिक प्रकोप न्यूनीकरण र पूर्व सावधानी एवं सुरक्षाको अवधारणाबारे शिक्षकहरूलाई सचेत गराई उनीहरूको माध्यमबाट विद्यार्थीहरूमा जनचेतना बढाउनु कार्यशालाको उद्देश्य रहेको छ ।

कार्यशालाको उद्घाटन गर्दै नेपाल भौगर्भिक समाजका सम्मानित सदस्य डा. चन्द्रकान्त शर्माले प्रत्येक वर्ष तीन सयदेखि चार सय व्यक्तिको मृत्यु र करीब रु. २५ करोडदेखि रु. ४० करोडसम्म भौतिक सम्पति प्राकृतिक प्रकोपबाट क्षति हुने गरेको नेपालमा शिक्षकहरूको माध्यमबाट यसबारे जनचेतना जागृत गराउनु निकै सान्दर्भिक हुने विचार व्यक्त गर्नुभयो ।

समारोहका सभापति शिक्षा मन्त्रालयका सहसचिव चुमानसिंह बस्नेतले प्राकृतिक प्रकोपबाट बर्षेनी पीडित हुने नेपाल जस्तो देशका लागि यस्ता कार्यक्रमले संकटकालीन अवस्थाको लागि तयार रहन र भविष्यको कार्यनीति बनाउन महत्वपूर्ण योगदान दिने बताउनुभयो ।

नेपाल भौगर्भिक समाजका अध्यक्ष डा. विशालनाथ उप्रेतीले विश्वमा बदलिंदो प्राकृतिक स्थितिमा ध्यानमा राखी धेरै मुलुकहरूले

विद्यालय पाठ्यक्रममा भू-विज्ञानलाई समावेश गरेको सन्दर्भमा नेपालका शैक्षिक पाठ्यक्रमहरूमा पनि भू-विज्ञानलाई स्थान दिनु अति आवश्यक भइसकेको चर्चा गर्नुभयो ।

भूकम्प प्रविधि राष्ट्रिय समाज नेपालका अध्यक्ष शिवबहादुर प्रधानाङ्गले काठमाडौं उपत्यकालाई भूकम्पको जोखिमबाट सकेसम्म कसरी बचाउन सकिन्छ भन्ने अध्ययनमा गत तीन महिनादेखि काठमाडौं उपत्यका भूकम्पीय जोखिम व्यावस्थापन आयोजना कार्यरत रहेको र यसले पनि विद्यालयलाई आफ्नो मूल कार्य क्षेत्र बनाएको उल्लेख गर्नुभयो ।

सो अवसरमा लुथरन वर्ल्ड सर्भिसका प्राकृतिक प्रकोप न्यूनीकरण विभागका निर्देशक टड स्ट्यावलले हरेक वर्ष साना र हरेक पाँच-दश वर्षको अन्तरालमा ठूला प्राकृतिक प्रकोप भोगिरहेको नेपालमा सामान्य कुराहरूमा सावधानी अपनाए पनि धेरै जनधनको क्षति हुनबाट जोगाउन सकिन्छ भन्नुभयो ।

जेनेभास्थित प्राकृतिक प्रकोप न्यूनीकरण अन्तर्राष्ट्रिय दशक सचिवालयका वरिष्ठ प्रतिनिधि जोन होर्डिङले प्राकृतिक प्रकोपबाट हुने जनधनको क्षति घटाउन र यसका लागि ज्ञान र प्रविधिको स्थानान्तरण गराउन आफ्नो सचिवालयले मुख्य जोड दिएको बताउनु भयो ।

तालीम कार्यशालामा नेपालका हिमालयहरूको भौगर्भिक परिचय, नेपालमा प्रकोप व्यवस्थापन, पहिरोको जोखिम, हिमताल बिस्फोटन, भूकम्पीय प्रकोप न्यूनीकरण कार्यक्रम र विद्यालयहरूमा भूकम्पीय सुरक्षाबारे सहभागीहरूलाई अवगत गराइने कार्यक्रम रहेको छ ।

साभार: गोरखापत्र दैनिक, २५ मंसिर २०५४



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Abstracts and papers presented at the National Meeting cum Seminar on "Natural Disaster Reduction in Nepal: Experiences and Challenges"

Disaster Management Training in Nepal: Experience and Challenge

Singha Raj Uprety

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This paper is devoted to shed light on the strategy taken and activities performed pertaining to the disaster management (DM) training programmes in Nepal. The paper consists of four main sections namely; general introduction to the interrelationship between disaster and development, significance of DM training, necessity of DM training in Nepal and experiences gained and challenges to be encountered by Nepal in Disaster Management Training Programmes.

In the first section, an attempt is made to indicate a symbiotic relationship between disasters and development process with a question "are we beating the true path of development process?" Here the development actors are cautioned to hear and care the disasters issues mainly induced by development actions by conducting Environmental Impact Assessment as well as Disaster Impact

Assessment *inter alia*, for establishing sustainable development process.

The second section deals with the importance of training and the necessity of disaster management training in Nepal. Here the necessity of disaster-specific training programmes are insinuated from geophysical, socio-economic and development projects selection and implementation standpoints.

The third section of this paper is devoted to highlight the progress made by Nepal in the disaster management training domain. Here the focus is laid upon the training programmes of disaster management orientation rather than of rescue and relief skill orientation.

Finally, the fourth section ends up with outlining the experiences gained and challenges to be encountered in terms of promoting and extending the Disaster Management Training Programmes in Nepal.

A farming problem in the Nepalese hills and some insights into the traditional technique of management: experiences from the Bagmati Watershed Area

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ABSTRACT

In Nepal, the monsoon rain, which is the major source of water, brings about 80% of the total annual precipitation in just four months. Though the monsoon rain is very critical for existence, the heavy rain also brings sorrows by causing floods, landslides, gullies, loss of standing crops and threats to life and properties. On the other hand, apart from few winter showers, the only source of water for eight months is the water

retained in the soil and underground aquifer which is fed by the monsoon rain. Farming and other development endeavours suffer at both period because of either "too much water" during rainy season or "too little water" during winter and summer. To cope with the situation, mountain settlers long ago had developed techniques of managing monsoon runoff by digging ponds at strategic locations in order to store as much water in the ground as possible during the monsoon so that there is less water

causing damages in the monsoon season and more water available in the winter. They took part of the excess water causing damage and used it to recharge the ground water. After the introduction of the piped water supplies, ponds lost their importance and consequently were abandoned. Realising the traditional wisdom behind uses of ponds, the ponds were revived and used in the hills of Lalitpur and Kavre districts to stabilise landslides and gullies in 1988. The technique not only helped in slope stabilization but also in conserving valuable nutrients which increased maize production by more than 50% in the hills.

GENERAL

It seems that water received through monsoon rain is infinite. This is not true. However, amount of water through the monsoon rain is the major source of water in Nepal. Fig. 1 shows that three meteorological stations recorded 86% of the total precipitation in four months between June and September. Within this period the actual rainy days are usually about 60 to 80 days. However, most of the water is lost through runoff, evaporation, transpiration, and various other hydrological processes. Only a small part of it is retained in ground water and in soil.

During July and August, newspaper headlines carry news on people affected by floods and landslides, loss of lives and properties, and damages to expensive infrastructure and standing crops due to heavy rain. During the same period, there are also many other losses that go unrecorded such as loss of valuable nutrients from the hill farms and micro level changes in the landscape that continually alter faces of the hills. When the monsoon is over big festivals of Dasain and Tihar are enjoyed before the cold winter months. Before the pains and pangs of the heavy monsoon rain has slipped off of people's minds, there comes the problem of shortage of water basically for drinking and irrigation. As the months of March and April approach, the reservoirs begin to dry out resulting in load shedding, water supply becomes acute, dairy production declines, local fresh vegetables disappear from the market, and diseases spread. All these make our daily lives almost miserable. Once again, cities and towns appear in the news headlines but this time not because of heavy rain but because of shortage of water. Then, the precious time is devoted in discussing the ways and means of making adequate water available to the people, and to our agriculture. It is then that another heavy rain of the monsoon awaits at the door step just few months away. The cycle continues.

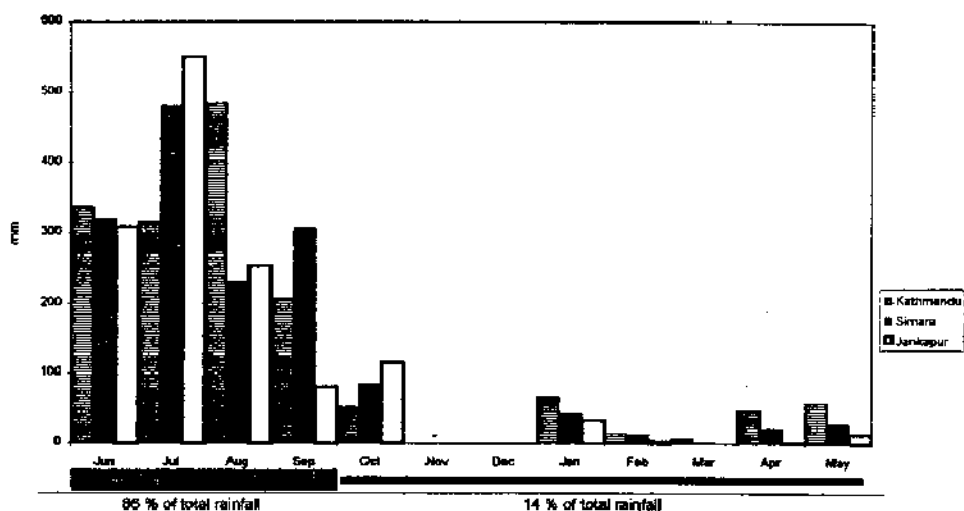


Fig. 1: Monthly rainfall of three stations 1996.

WATER RELATED DEVELOPMENT WORKS

Actually, water - the important natural resource that comes free of cost but only for a limited period, becomes problem at two different times. At one time, it is too much and at the other it is too little. In fact, most of the problems that face Nepali lives whether in the hills or in Terai, are associated with water. Out of four major development priorities (i.e. water supply, irrigation, electricity, and roads) of the villagers as well as, if not more, of the politicians, three are water related.

This skewed distribution of water becomes causes of disasters in some places making news headlines, whereas, its overall impact, though hinders our development endeavours in a larger scale remains unnoticed. Because for many water related projects the sources dry out towards summer when we need them most. Since a majority of people in the hills are farmers, the discussion is focused on the skewed distribution of water in relation to hill farming.

Monsoon Rain and the hill farming

Agricultural productivity is probably the hardest hit, widespread, and long lasting but still unnoticed consequence of the "too much or too little" water situation. In this paper, an attempt was made to show how managing monsoon runoff may lead to disaster reduction and agriculture development, both of which are vital for overall development of the hills.

Mountainous areas of Nepal, which homes more than 10 million people, has experienced a steady decline in agricultural productivity by about 1% per year in the last three decades. On the other hand, growth rate of human population has remained well over 2%. Results of the government's efforts to enhance agriculture productivity, which has always remained on the top of the development priorities for last four decades, are still below satisfactory level. During the same period, many nations have had success in green and white revolutions. Agriculture technology and scientific information have advanced quite a bit. As far as Nepal is concerned, she was not lagging so much behind other Asian nations for a better tomorrow. Unfortunately, even after decades of our efforts, a majority of hill farmers face food shortages for almost three to six months a year Nepal, once

food exporting country, has started to import thousands of tons of food every year to feed her population.

Problems of hill farmers

Poverty: Many of the farmers need to migrate elsewhere and work as unskilled labourers to make their living for 3 to 6 months. They also suffer from other problems associated with poverty such as minimal education, poor health, and so on. Poverty rises abruptly after every successive mountain due to proximity of the market for farm products.

Declining productivity: Upon careful examination one can notice that many of the hill slopes that have forest patches today have scars of cultivated terraces indicating that these slopes were cultivated in the past. As the erosion set in and the productivity declined people abandoned the land and allowed natural regeneration of the forest. When it is no longer possible to feed the family from the harvest, a farmer moves elsewhere - many times permanently.

Landslides/gullies: Landslides and gullies are very common features of the midhills in Nepal. Many of them are active during the monsoon season. Many of the landslides are found in or around the cultivated areas.

Lack of water: Immediately after the monsoon season the hills become so dry that there is hardly any water for winter grasses let alone for winter crops. With outside funding sources villagers have hooked pipes to distant sources of water in order to meet household needs.

Lack of fodder: Domestic animals, without which farming in the hills is unthinkable, need to feed 365 days a year. Unlike fuel wood, there is a set of grass or tree leaves which animals eat. After the monsoon season hills face an acute shortage of fodder for animals.

Cause of the problems

One of the reasons that we led to less success in the hills is that the problems were addressed in isolation. It is also because the address was directed to symptoms of the problems rather to the cause of the problems. What is the cause of the problem? To seek an answer to this, some cases are presented.

Case 1: To improve agriculture, adequate moisture is required in the soil during the dry

period, which may be provided through irrigation. For the irrigation, there must be enough water at the source. The source is fed by the groundwater, which again is recharged by the monsoon rain. If most of the rainwater during the monsoon is lost through runoff and so on, ground water does not get fully recharged. This means less water available for irrigation/water supply.

Case 2: Degradation of farmland in the hills affects the farmers more than degradation of other types of land because the livelihood of a family depends on the productivity of his farmland. Moreover, most farmland in the hills acts as a "nutrient sink", that is, it absorbs valuable nutrients harvested from the forest and used as manure. Forest, shrub, and pasture are the major source of nutrients required for agriculture pursuits. A lot of farmers' (and especially women's) time is spent collecting fodder for the animals providing manure. When a significant part of the valuable nutrients collected by poor farmers from the forest is washed by the monsoon rain and lost without being noticed, each farmer has to raise more animals and collect more fodder in order to maintain or to increase his level of food production. With a steady soil and nutrient loss over a period of time, when it becomes unprofitable to cultivate his land and support his family, the farmer abandons it and cultivates a new slope or migrates elsewhere.

If there is quite a regulated monsoon rain, and not much loss of manure, there would have a better harvest without having to have a large herd of animals to manure the farms. Then it is not needed to collect a large amount of fodder. Forest would have better chance to regenerate, and above all, farmers' families would have less work to do.

Case 3: Stream or riverbank cuttings are another problem associated with flood. When sediment is added to the flowing water, its erosion capacity increases. If the stream does not bring sediment from the watershed above, the chances of bank cutting is less likely, especially in small watersheds. The uncontrolled and diffused runoff from the watershed contributes sediment to the stream.

Case 4: Though many other factors such as geology, slope, vegetation are responsible, a landslide usually occurs when there is too much water at the slope. When a road is constructed, one of the things that becomes a concern is the cost of construction. To reduce the cost two or three small gullies are connected through the side drains and let the water run through a culvert. The natural gully below the road can not carry this additional water and leads to failure.

Case 5: It is generally taken for granted that planting trees and grasses stops a landslide or a gully from advancing. But in reality, plants can only grow when the surface stops moving, which means that water in the slope has to be reduced before the surface stops moving.

Fig. 2 summarises some of the problems caused by the skewed distribution of water

The above cases show that increased amount of runoff during monsoon which, in fact, begins to generate from the mountain ridges contributes:

- to nutrient loss that results in low food production,
- to destabilising slopes, which discourages vegetation establishment,
- to add sediment that results in bank cutting,
- and most importantly contributes,
- to less water available to recharge ground water that is necessary for the survival of the living things.

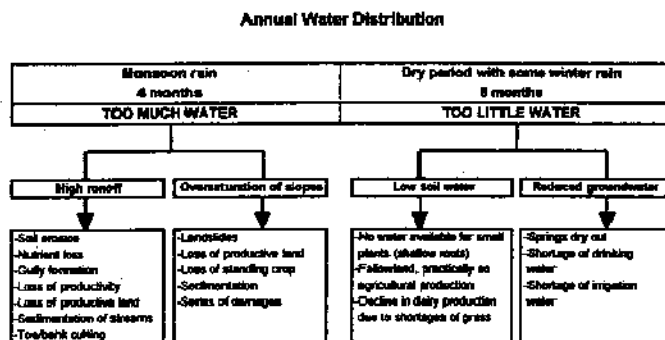


Fig. 2: Summary of problems caused by the skewed distribution of water

TRADITIONAL TECHNIQUE OF MANAGING RUNOFF

Probably the first settlers in the mountains understood the effects of accumulated runoff flowing down the hill slopes and resulting hazards around settlements. On the other hand, after the monsoon season as the mountains became dry they also faced hardships of getting adequate amount of water for household uses and for farming. To reduce the problem, they developed the technique of storing runoff water by diverting it to simple ponds dug at strategic locations. Primarily, they were dug to store water for few months so that it could be used for livestock. It is not clear whether the farmers understood a pond's role in recharging the ground water more efficiently. A pond, in fact, played a dual role of recharging the ground water and storing some water on the surface. Ponds became a common feature of village life in the hills. But unfortunately, they lost their importance and were abandoned when pipes were hooked to distant sources to bring water to the villages. Runoff was not collected any more. Ponds got silted.

RECENT EXPERIENCES IN THE BAGMATI WATERSHED AREAS

With the realisation of the fact that the conventional methods of environmental protection were not being effective and also because they were expensive, indigenous techniques are followed for resource management in 1987. This is believed to be appropriate for the hills and economy. Though the old techniques had already disappeared, some farmers in the hills of the Lalitpur district are still using ponds in private as well as common lands. They divert the runoff to stabilise

landslides, which threaten to their houses. The technique was adopted with some modification to the entire slope of the hill. The results after one year was very encouraging. In the following years, the technique was transferred to several villages.

Since 1989, using this old technique of runoff management, farmers in the Bagmati Watershed areas of Lalitpur and Kavre have been able to increase maize production by about 50 % without using inputs not available locally, grow winter vegetables using pond water, and stabilise active landslides/gullies without engineering structures. Trees have regenerated in areas that were very dry before ponds were dug.

No studies have been made to evaluate how much water a pond can actually add to the groundwater. But it is obvious that pervious bed of traditional ponds acts as funnel to let the water seep into the ground. At the same time, they intercept accumulation of runoff which would otherwise, upon accumulation, cause successive damages.

CONCLUSIONS

It can be said with a fair degree of confidence that managing monsoon runoff, in fact, is addressing the cause of the problem facing hill farmers. In addition, it is also building the foundation for environmental protection and economic upliftment of the inhabitants. It is not merely digging ponds and diverting runoff but it is dealing with "too much water or too little water".

Saving some water when there is "too much" and use it when there is "too little" reduces many of the problems associated with skewed distribution of water, which can be referred as runoff management.

Disaster Management In Nepal: Issues and Challenges

Sushil J.B. Rana

Ministry of Home, Singh Durbar, Kathmandu, Nepal

The main objective of this paper is to provide comprehensive information on the present status of disaster response system carried upon by the government sector, and initiatives

taken up by it. Furthermore, an attempt has also been made to highlight the issues and areas of concern for the betterment of disaster management in Nepal.

A general background of the natural features of the kingdom along with her vulnerability to disasters have been discussed in the introductory part. A brief introduction of recurring disasters and their causes and current status of disaster management have also been included in opening part of the paper.

Similarly, a general scenario of disasters in Nepal with comparative data on disasters are presented along with general discussion on types of natural disaster which prevail in the kingdom.

A summary of current legal provisions, organisational structure for managing disasters, IDNDR National Committee and its effort on disaster reduction, sectoral activities and general background on disaster response system has also been incorporated. Initiatives taken up by the government in improving disaster management capacity of the country are also highlighted.

Finally, an effort has been made to raise issues and challenges currently experienced which should be considered in order to improve disaster management capacity of the country.

Controlling vehicular pollution in the Kathmandu Valley ?

K.M. Joshi

Kathmandu has often been branded as one of the most polluted cities in the world. It was even once called the second dirtiest city after Mexico so far as vehicular pollution was concerned. And in Kathmandu, everybody is blaming everybody else for this state of affairs. How real is the problem?

A concerted effort to solve this menace was initiated some five years back. What has been done since then? How much has been achieved? A close look at the situation shows that nothing much tangible has been achieved. Only one testing machine (out of ten numbers procured then) is in operation now to monitor diesel vehicles.

One positive outcome of whole exercise is the quantum jump in the level of awareness about

the issue amongst all concerned. In the meantime, the vehicle mechanics have come to develop methods to hoodwink the officials and the officials, in turn, have tried to remain ahead. The classical chase has begun. It only shows how we may have drifted from the real problem? Introduction of electrical vehicle, though in a limited way, is another positive development.

One major weakness has been the failure to come up with the appropriate rules and regulations so far, on whose absence the law enforcing agency has been forced to extend the clause of "traffic violation" to book the offenders.

An attempt is being done in this paper to analyse the situation then and now.

A guideline for landslide investigation: an experience from DPTC Model Sites

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Enormous variation of topography and fragile geology of young Himalayan mountains in Nepal are subjected to soil erosion, high intensity rainfall and earth tremors, all of which contribute to severe landslide problems. Huge amount of maintenance fund is invested every

year for the clearance of landslide. Landslide is not treated as one of the important parameters during planning and design of infrastructures. Even if treated it is done without detailed investigation which aggravate the problem furthermore. So development of appropriate and

sustainable technology suitable for various types of landslides is vital for the reduction of landslide disaster in the country.

Many organisations such as Mountain risk Engineering Unit of the Tribhuvan University, ICIMOD, Department of Mines and Geology are engaged in the research of the landslides. Also, there are some cases of landslides, such as the landslides on both the sides of Charanavati river along Lamosngu Jiri road, landslides along Arniko Highway, etc. where intensive study and prevention works has been carried out. Yet, there is no general guideline which a technician can refer in the practical field.

DPTC is trying to develop appropriate technology for landslide study and prevention suitable for Nepal. Four model sites have been undertaken for action research. The low-cost technology for monitoring as well as for prevention works in these landslide model sites is being used to evaluate the technology.

In the present paper, starting with the classification of mass movements, appropriate technology for investigation of landslides as a draft guideline will be mentioned. It is tried to make this guideline more suitable for civil engineers who are involved in planning, design, construction and maintenance of infrastructures.

Soil erosion problems in the midland of Nepal with reference to the Trisuli model site, Nuwakot district, central Nepal

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ABSTRACT

Soil erosion has been accelerating due to deforestation in the Midland of Nepal which has high erosion potential because of fragile geology and climatic condition. Especially gully erosion and surface erosion problems are serious in the low altitude area covered with laterite soil. The Water Induced Disaster Prevention Technical Centre (DPTC) selected a model site of gully and sheet erosion of laterite to investigate the erosion processes and suitable counter measures in Trisuli, Nuwakot in central Nepal in 1993. The monitoring result of erosion rate and the effect of erosion control works are discussed in this paper.

Gully has been expanding 40-77 cm per year at the head scarp without vegetation cover and 1 m with partial vegetation. Erosion rate has been decreasing at the gully whose bed was protected by check dams and channel works from stream erosion. These structures also help vegetation coming to the side slopes of gully.

The rate of sheet erosion on laterite was measured by monitoring pegs and varied from 0 cm to 1.5 cm in depth per year. These values correspond to those of previous study on soil-loss (Laban, 1978). Since the fact that plants do not

favour lateritic soil therefore suitable grass plantation for dry and inferior chemical condition and soil protection by engineering measures should be combined.

Both erosion by much run-off at the time of heavy rain and less water in dry season should be taken into account to reduce erosion problems in the area covered by laterites.

INTRODUCTION

Soil erosion is an important cause of land degradation in mountain terrain of Nepal (Sthapit, 1996). In the Midland, which is often composed of relatively low-relief topography, gentle slopes or river terraces covered with thick soil, has to face serious gully erosion and surface erosion problem due to deforestation. The erosion problem is severe in the laterite soil, especially where plants hardly grow well because of chemical richness of Fe and Al. This type of soil is predominant in low-altitude area.

The Water Induced Disaster Prevention Technical Centre (DPTC) selected a model site at Trisuli, Nuwakot in central Nepal to investigate the erosion processes and suitable countermeasures for gully and sheet erosion of

laterite. Erosion process has been monitored and trial control works have been implemented since 1994. In this paper, the monitoring result of erosion rate and adopted countermeasures are discussed with reference to that model site.

TERRAIN PRONE TO SURFACE EROSION AND GULLY EROSION

Gully erosion is serious in the case that the land which consists of thick soil or unconsolidated rocks has got erosion potential by relative uplifting of the land. Three factors favourable for gully erosion can be pointed out in this context in the Midland.

(1) Phyllite which is deeply weathered (WECS, 1987) is common in this region.

(2) This area is often composed of up-lifted low-relief terrain of erosional origin (Iwata, 1988) which tends to keep thick residual soil according to the long-term slope evolution processes by Davis (1912). This terrain had got low-relief by long-time dissection and has been raising by crustal movement (Iwata, 1985). The land had enough time for weathering and have been protected from erosion processes.

(3) Due to heavy sediment load in river water (ex. Mezaki, 1985) thick fine material originating from flood composes river terrace surfaces. River terraces, uplifted low-relief terrain and slopes composed of phyllite are susceptible to gully and surface erosion. If forest is devastated, increasing surface water and weathering by soil moisture changes promote surface erosion on upper slopes and gully erosion on down slopes promptly.

SITE CONDITION

The model site of DPTC is located on the slopes of a river terrace facing Tadi Khola

(River), a tributary of Trisuli river. Relative height of river terrace surface from the riverbed of the Tadi Khola is waround 100 m and its elevation is around 600 m. Upper and lower layers which consist the river terrace are latosol with 5-8 m in depth and fluvial sandy gravel soil with more than 50 m in depth, respectively.

After deforestation took place around thirty years ago, serious sheet erosion on laterite and gully erosion started. This area was selected as a demonstration site of soil conservation activities by Department of Soil Conservation and Watershed Management (DSCWM), Government of Nepal in 1989, where plantation and some structural measures have been done (DSCWM, 1991). Consequently in the model site of DPTC gullies located in western part (G-1 and G-2) are mostly covered with grasses or trees, but the tributaries of the eastern gully (G-4) are still under very unstable condition with less vegetation cover.

Monitoring of gully erosion and sheet erosion has been executed since January 1994, and model control works such as check dams, channel works and grass plantation have been carried out mainly in the catchment area of G-4.

RATE AND PROCESS OF GULLY EROSION AT THE MODEL SITE

Gully Erosion

Erosion rate of gully heads has been monitored by measuring the distance between fixed iron pegs and the crown of a gully head for G-1 and the branch gullies of G-4 (RB3,4,5,5A). These iron pegs were installed into line, to which the distance was measured perpendicularly.

Table 1 shows present conditions of the gully studied. Gully bed of G-1 are covered with grass and trees planted by DSCWM. Crown of

Table 1: Monitoring site for gully head expansion.

| Gully No. | Vegetation | | Gradient | Length(m) | No. of monitor pegs | Remarks |
|-----------|----------------------|--------------------|----------|-----------|---------------------|---------------------------|
| | Gully bed | Gully head | | | | |
| G-1 | grass and tree cover | partly shrub cover | 1/1.5 | 55 | 9 | plantation by DSCWM |
| G-4RB5A | rare | rare | 1/1.9 | 75 | 5 | bamboo plantation in 1997 |
| G-4RB5 | rare | rare | 1/1.7 | 80 | 5 | |
| G-4RB4 | partly grass cover | partly grass cover | 1/1.7 | 80 | 7 | channel works check dams |

G-1 gully head are partly covered with shrub. Channel works and check dams had been constructed in RB-4 by DPTC since 1994. Baboo plantation was executed in RB5A in 1997, but the vegetation condition of RB5 and RB5A is still poor. Though monitoring pegs were installed more than the numbers shown in Table 1, the pegs which give accurate data are used in this paper.

The result are shown in Fig. 1, where minus value means distance expansion between pegs and crown of a gully head. Though erosion is expected to be active in rainy season, the data after August was not available in 1995.

enlargement of distance might be due to development of vertical cracks under dry soil condition which are opening towards rainy season because of lack of lateral support at gully head.

Fig. 2 shows the relation between precipitation and erosion amount during monitoring periods for each rainy season. It can be said that large precipitation promote more erosion. However expansion rate of G-1 gully head whose foot slopes are covered with grass and trees recently was 32.2 cm/year in rainy season of 1994 and became smaller since 1996. It is also noticeable that the expansion rate of the gully RB4 where channel works by PNC

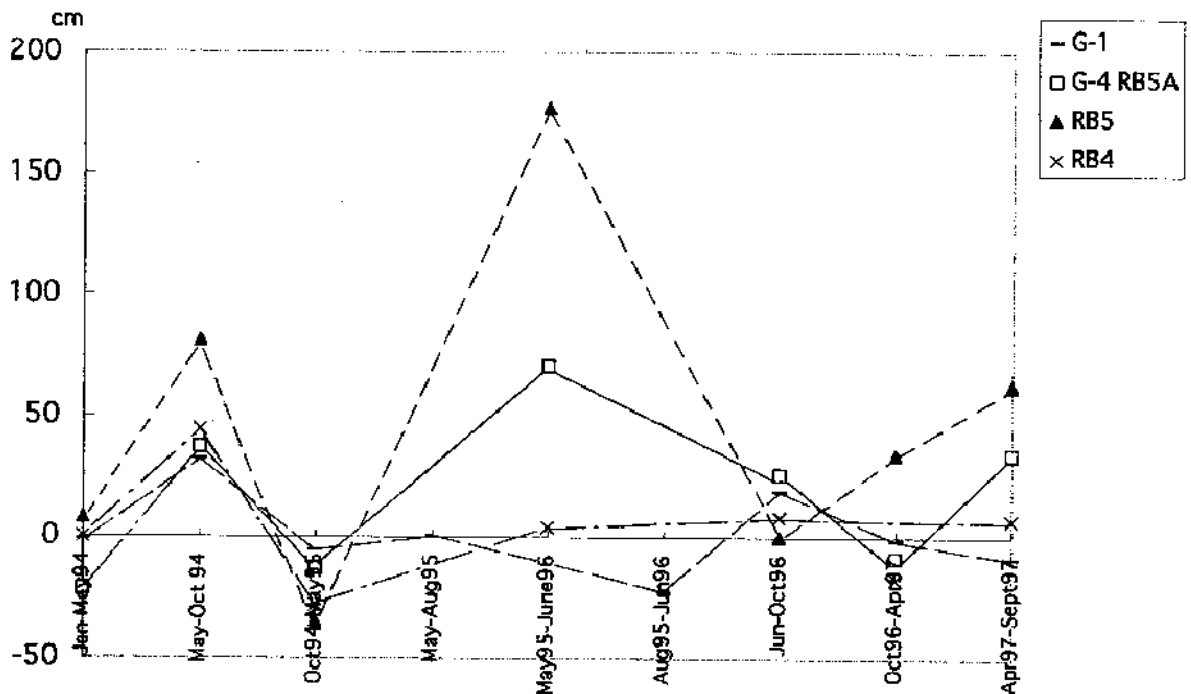


Fig. 1: Gully head erosion (distance reduction) during each monitoring period (—distance expansion)

Gully has been retrogressively expanding 3.1 cm/year, 36.5 cm/year, 81.8 cm/year and 4.4 cm/year in average from 1994 to 1997 at the heads of G-1, G-4RB5A, RB5 and RB4 respectively. It can be poited out that during monsoon season gully heads expands (eroded) and the monitored distance enlarges during dry season conversely (Fig. 1). Since soil block collapse and rain drop erosion are the major processes of gully head expansion (erosion) accroding to regular monitoring of the sites, this

concrete blocks and gabion check dams were carried out in June-July 1994 had become smaller in comparison with those of RB5 and RB5A after 1994. The gullies RB5 and RB5A, which are less treated, are still actively expanding at the heads because vegetation cover is very poor.

Sheet Erosion

Steep barren ridge (R), steep grass-covered valley head (V) and barren gentle crest slope (S)

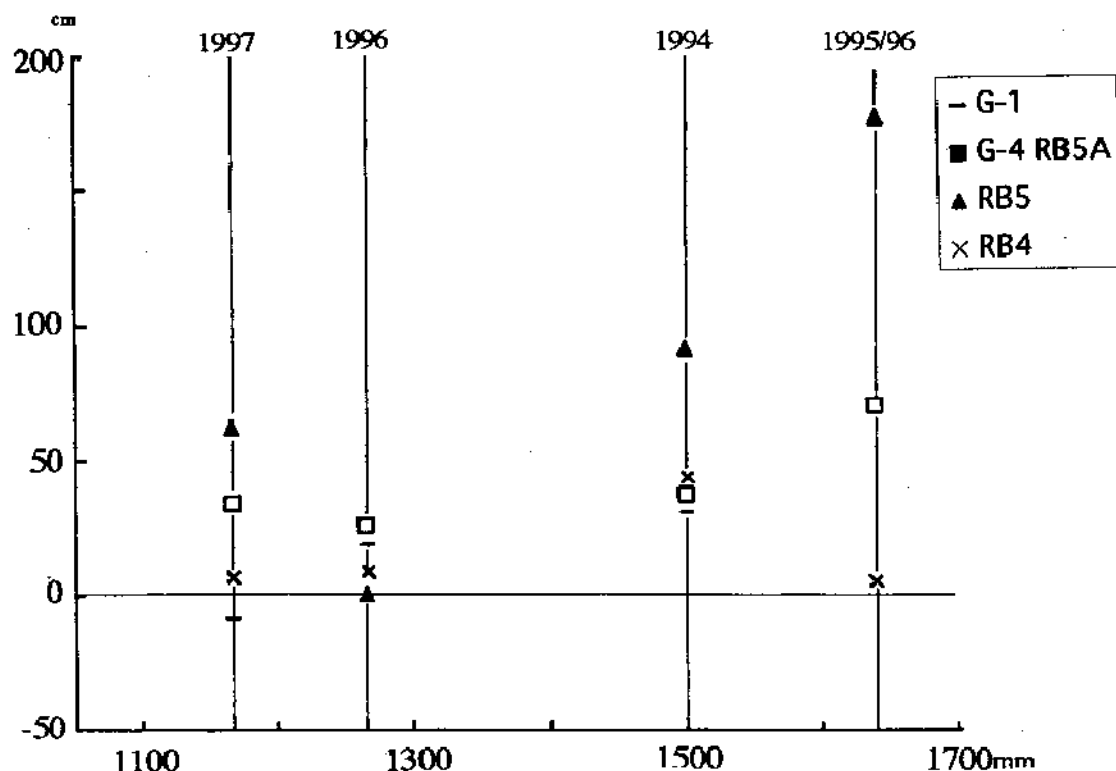


Fig. 2: Precipitation and erosion amount during monitoring period for rainy season.

were selected for monitoring sheet erosion rate of latosol (Table 2). Iron pegs were installed as a grid, and the length above the ground (Takei et al., 1981) has been monitored since January 1994. Since the slopes behind each site are small and covered with shrub or trees, monitored length indicates erosion (or deposition) rate and soil loss from the monitored slope as well. Surface rate erosion is presented in Table 3.

The other monitoring site (N) was also selected on the crest slope with convex cross section, and monitoring work was done only on 20th September and 8th June in 1997.

Average erosion rate per year is 1.03 cm, 0.63 cm, 0.03 cm (plus value means deposition) on the slopes (R), (V), (S) respectively.

Table 3: Surface erosion rate (unit:cm)
(each rainy season and average (cm/year) from Jan. 1994 to Sept. 1997)
- = erosion, + = deposition

| | R | V | S | N |
|--------------------|-------|-------|-------|------|
| May-Oct 1994 | -0.75 | -0.15 | 0 | |
| Apr-Aug 1995 | -1.66 | 0.25 | -0.41 | |
| Jun-Oct 1996 | -1.78 | -2.65 | 0.28 | |
| Apr-Sept 1997 | 0.33 | -1.59 | 0.11 | |
| Jun 8-Sept 21 1997 | | | | 1.53 |
| Average (cm/year) | -1.03 | -0.63 | 0.03 | |

Table 2: Monitoring site for surface erosion

| Site | Area (m ²) | Soil | Topography | Gradient (degree) | Vegetation | No. of monitor pegs | Remarks |
|------|------------------------|----------|-------------------|-------------------|------------|---------------------|---------------------|
| R | 48 | Laterite | Ridge slope | 32 | rare | 20 | |
| V | 72 | Laterite | Valley head slope | 30 | grass | 27 | |
| S | 400 | Laterite | Crest slope | 12 | rare | 36 | |
| N | 500 | Laterite | Crest-side slope | 5-40 | rare | 60 | small planted trees |

Erosion or deposition during each rainy season is shown in Table 4. The data obtained from the slope (N) is 1.53 cm during the rainy season of 1997. On steeper slopes larger erosion rate was recorded within the area of the slope (N). Erosion or deposition rate on the gentle crest slope (approximately 10° or less) is so small such as 0.025 cm (deposition) on the slope (S) and 0.153 cm on the slope (N) that soil on gentle barren slope is considered to be almost stable. However, the steep part (30-50°) of the slope (N) was eroded 3.62 cm deep in the rainy season of 1997. The erosion amount is so smaller than that of gully heads that the relation of it with precipitation is not discussed.

Table 4: Soil loss rate by land use (Laban, 1978)

| Landuse | Annual soil loss (tons/hectare) |
|---------------------------------|---------------------------------|
| Well managed forest land | 5 - 10 |
| Well managed rice terraces | 5 - 15 |
| Poorly managed sloping terraces | 20 - 100 |
| Degraded range land | 10 - 200 |

Comparison with previous study

From these values soil loss is 63-153 m³/ha./year which is a little larger than that of degraded range (Table 4) land and correspondent to severely gully land in Mahabharat Lekh estimated by Laban (1978). In comparison with the previous study on soil loss reviewed by Sthapit (1996) erosion rate of the Trisuli model site is in the largest range in Nepal.

Carver and Nakarmi (1995) pointed out the importance of pre-monsoon rain on soil erosion because vegetation cover is less during this time. Though analysis has not yet been done in detail on monthly erosion rate, considerable erosion in April/May was recorded on the slopes (R) and (S) (1.65-1.81 cm in 1995 and 0.23-0.3 cm in 1997) in spite of small precipitation. On the other hand Table 5 shows the rate of precipitation and that of erosion (expansion) amount of gully heads during the former period (until July) of rainy season in whole rainy season in each year. The relation between the rate of precipitation and erosion amount is different at each gully, and erosion during the former period of rainy season is not concluded to be important. Further monitoring is necessary to evaluate the importance of pre-monsoon at this model site.

COUNTERMEASURES AND THEIR EFFECT

The monitoring result of gully head expansion proved the importance of vegetation cover to control gully formation at G-1. The effect of channel works and check dams which was indicated by the data of the gully RB4 can be also understood in this context as follows:

- (1) to control vertical erosion on a steep gully bed
- (2) to protect side slopes from slope collapse
- (3) consequently vegetation can grow on stabilised slopes

Photos of RB4 before and after the construction indicate that grasses expanded their territory on the side slopes and crown of the gully head.

Table 5: Rate of precipitation and erosion amount during May-October 1994 of rainy season in whole rainy season

| Monitoring period | Precipitation from May to July (mm) | Precipitation of monitoring period (mm) | Erosion until the monitoring date in July/ erosion during monitoring period (cm) and its rate (%) - = distance expansion | | | |
|-------------------|-------------------------------------|---|---|-------------------|---------------|---------------|
| | ()=rate in monitoring period (%) | | G-1 | RB5A | RB5 | RB4 |
| May-Oct 94 | 663.7 (44.2) | 1500 | -4.4/32.2 (0) | 69.5/109.4 (63.5) | -10/81.2 (0) | -5.9/44.1 (0) |
| May 95 -Jun 96 | 862.2 (51.2) | 1682.9 | | 6.4/70.4 (9.1) | 2.5/177 (1.4) | 2/3.9 (50) |

Soil protection works from surface erosion was carried out by grass plantation and making small steps (about 20 cm wide) in 1995, but plantation was not successful because of very dry condition. In July 1997 *Stylo*, *Mollases* and *Dinanath* which was effective grass for soil erosion control in the Dang district were planted on barren slopes of the model site. According to the inspection after this rainy season *Stylo* and *Mollases* have grown 3-30 cm and 6-8 cm high.

CONCLUSION AND RECOMMENDATION

Soil erosion problems of lateritic area due to surface and gully erosion were discussed with reference to the model site of DPTC focusing on erosion rate obtained from regular monitoring and effect of model control works.

Expansion rate of gully head is 3.1, 63.5, 81.8 and 4.4 cm/year in average at G-1, RB5A, RB5 and RB4, respectively. Time-sequential changes of the expansion rate indicate positive effect of vegetation, channel works and check dams to control gully erosion. Gully head has been retrogressively expanding by soil block collapse and rain drop erosion in rainy season preceded by crack development in dry season.

Sheet erosion was also monitored by peg method on the slopes R, V, S and N with different topographical or vegetation conditions. Average erosion rate is -1.03, -0.63, 0.03 cm/year (deposition), and -1.53 cm/year at R, V, S and N respectively. Erosion is not active on gentle slopes in spite of barren condition.

In comparison with previous study soil loss by surface erosion is estimated to be in large range in Nepal.

Bio-engineering works such as the combination of channel works/check dams or terracing works and vegetation might be effective for gully and surface erosion control.

Because erosion rate is very small on gentle slopes of laterite in the model site, it is necessary to make slopes gentle and protect top soil from sheet erosion. It also improves dry soil condition for plantation. Combination of terracing works whose cliff is protected by vegetation or some structures and grass plantation can be proposed to control surface erosion. Run-off control is also important.

Increased run-off and weathering promote soil erosion, and decreased soil moisture prevents vegetation after deforestation. Both much water at the time of heavy rain and less water in dry season should be taken into account to reduce erosion problems in the lateritic area.

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Pollution of river systems in Kathmandu Valley

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The Kathmandu basin is about 607 sq km in area and the mean annual rainfall is about 1740 mm. Most of the rainfall occurs in the monsoon period (June-September) so there is too much of water in this season where as too little in dry season. In the dry period when the groundwater table is lower than the riverbed, aquifers get recharged from the river waters. About 50% of the water supply in the valley is obtained from the river resources so due to very low river discharge, adequate dilution of the pollutants is not possible.

Local people have sentimental feelings about the rivers as there are many Hindu and Buddhist shrines and areas of cultural and religious importance along the river banks. Bagmati is the main river and it has eight main tributaries. In recent years, the environmental situation of the river system is getting degraded. Frequent out break of epidemics related to water

borne diseases has been a major problem. The river beds are getting deeper, the banks are getting narrower, and the waters are getting polluted.

Main factors affecting the water quality in the rivers are:

- direct discharging of sewage into the water courses
- discharging of untreated industrial wastes
- squatter settlements along the river banks
- keeping and slaughtering of livestock on the river banks
- washing of vehicles, vegetables and others in the river
- street run off and agricultural run off.

It is hoped that the newly established Ministry of Population and Environment will play leading role in the days to come to deal with this problem. The new Act for controlling pollution should be enforced as soon as possible

यस समाजका आजिवन सदस्य श्री कृष्णामुरारी अमात्यज्यूले
यस समाजको आर्थिक स्थितिलाई मजबुत बनाउनको लागि
महत्त्वपूर्ण योगदान गर्नुभएकोमा यस समाजको तर्फबाट
उहाँलाई हार्दिक धन्यवाद दिन चाहन्छौं ।

नवौं कार्यकारिणी समिति

नेपाल भौगर्भिक समाज

Database on disaster management capabilities in Nepal

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The Himalayan kingdom of Nepal lies in the central part of the Himalayan belt. Because of her location, characterised by a rugged topography, very high relief, variable climatic conditions, complex geological structure with active tectonic processes and continued seismic activities the country is prone to various types of natural hazards. The whole country faces high level earthquake hazards. The hilly and mountainous regions are vulnerable to landslide and debris flow hazards. Presence of numerous lakes of glacial origin in the northern part of the country has created the possibility of Glacier Lakes Outburst Floods (GLOF) in near future. Similarly, the flat piedmont plains of the Terai and the low valleys in the mountains are susceptible to floods. Beside these, almost every year smaller or larger part of the country is struck by one or several forms of other disasters such as drought, hailstorms, epidemic, fire, etc. The country has many times suffered from these disasters in the past resulting in huge losses in terms of loss human lives and damaged public properties and infrastructure. The earthquakes of 1934, 1980, 1988, and the floods of July 1993 are some of the examples of the natural disaster events, which caused considerable set back to the development efforts of the country.

Many of the disasters can be prevented or modified by the use of available technology. But there are many natural hazards, which are not yet amenable to modification or prevention. However, it is now widely recognised that the impacts of all disasters can surely be reduced significantly with the help of proper methods of disaster management, focussing on pre-disaster preparedness activities. This is the central message of the International Decade for Natural Disaster Reduction (IDNDR) declared by the United Nations for 1990-2000AD.

Faced with the problems to cope with the past disasters, Nepal has accumulated considerable experience in disaster management. Although many of the past experiences pertain to the post-disaster activities, but considerable efforts have been put to pre-disaster actions such

as preparation of hazard maps, studies and researches in aspects of natural hazards, etc. Furthermore, different government as well as non-government agencies have put considerable efforts in generating knowledge and data on hazards, disaster management procedures, and other supporting information.

These valuable information / data, maps, reports etc. are scattered across the different agencies, making any effective use of the information very difficult, if not impossible. At present, many times the knowledge on even the existence of this or that data/information is limited to the particular institution that generated the data; and at times the knowledge is limited only to the related individual.

Such condition precludes the development of any disaster management program or its improvement, since such programs should be based on the data/ information — existing or to be generated. Therefore, it is necessary to prepare an inventory of all the data (maps, reports, programmes, etc.) that are available with the different institutions, so as to understand better what is required to be done for the generation of additional, non-existing data/information.

Therefore, in order to assess the existing disaster management capabilities of Nepal and to develop it further in an efficient way, it was felt necessary to gather and compile all the existing data (secondary data) that are accessible, and to identify the leads to the depository of the data that are not easily obtainable.

The present work tried to address this important question. The UNDP/DMS and the Nepal Geological Society (NGS) entered into an agreement to collect and compile all the existing data/information that could be of use in the assessment of national capabilities in disaster management in Nepal. All known sources of information were contacted, and all accessible data/information, maps and reports have been collected to form what could be termed as the first database on disaster management capability in Nepal. However, a document of this type requires a continual updating of the database.

Kathmandu Valley Earthquake Risk Management Project (KVERMP) - an introduction

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ABSTRACT

Kathmandu Valley faces a large and growing earthquake risk due to the region's high level of seismic activity, its rapidly growing population, and a general lack of awareness about earthquakes. The Kathmandu Valley Earthquake Risk Management Project (KVERMP) will address this earthquake risk by conducting the following activities:

Evaluate the risk that faces modern day Kathmandu Valley and use this information to identify the actions to reduce this risk that are politically, economically, and technically feasible. An earthquake scenario that describes the possible effects of an earthquake will be created by a cross-section of Kathmandu valley leaders, using existing studies and information collected through interviews with leaders of critical facilities. A list of potential mitigation activities will be generated following the development of the scenario, which will be honed to a short list of achievable activities.

Begin the process of reducing vulnerability to one critical sector in Kathmandu Valley, namely public schools. This will be accomplished through a survey, filled out by school headmasters, which will be analyzed and verified by structural engineers. This process will define the risk faced by public schools. In addition, example retrofit designs will be made for three typical schools.

Raise awareness of earthquakes among the public, government officials, the international community resident in Kathmandu Valley, and influential organizations abroad. January 15 will be declared as Earthquake Day, commemorating the 1934 event. On this day, drills will be conducted by school children, and earthquake safety information will be distributed.

Build local institutions that can continue addressing Kathmandu Valley's earthquake risk after the completion of this project. The project will help to establish a Disaster Management Office in Kathmandu Municipality and will build the capabilities of the National Society of Earthquake Technology-Nepal (NSET) so that it can be established as a seismic safety "watchdog" for Nepal.

EARTHQUAKE RISK OF KATHMANDU VALLEY

Nepal has a long history of destructive earthquakes. In this century alone over 11,000 people have lost their lives in four major earthquakes. A 1934 earthquake produced an intensity of IX-X on the Modified Mercalli Intensity (MMI) scale in Kathmandu Valley, and destroyed 20% and damaged 40% of the valley's building stock. In Kathmandu itself, one quarter of all homes was destroyed. Many of the temples in Bhaktapur were destroyed as well.

This earthquake is not an isolated event. Three earthquakes produced intensities of IX-X in Kathmandu Valley in the 19th Century: in 1810, 1833, and 1866. The seismic record of the region suggests a return period of about 25 years, indicating that a devastating earthquake is inevitable in the long run and likely in the near future.

A large earthquake near the Kathmandu Valley today would cause significantly greater human loss, physical damage, and economic crisis than caused by the past earthquakes. With the Valley's burgeoning population of almost 1.5 million people, uncontrolled development, and a construction practice that has actually degraded over this century, the Valley becomes increasingly vulnerable to earthquakes with each

passing year. Recent experience of the consequences of large earthquakes in developing countries has led to the rule of thumb that shaking of intensity IX on the MMI scale will result in 5% of the exposed population to die and 20% to have injuries requiring hospitalization; for Kathmandu Valley today, that means that a repeat of the 1934 earthquake would result in 75,000 deaths and 300,000 serious injuries. Even if all critical facilities were to remain operational, this would be an unprecedented disaster. Figure 1 depicts the earthquake occurrence causing intensities of VIII to X in Kathmandu Valley and the population growth since 1800 AD. With such rapid growth, the impact of the future large earthquake is expected to be extremely high.

Despite this threat, there is no institution within Kathmandu Valley to assess earthquake risk or promote an earthquake risk management program. A weak economy, abundant poverty, and a tendency in the general population to ignore earthquake hazard in order to concentrate on fulfilling more immediate needs significantly contribute to the seismic vulnerability and lack of earthquake preparedness in Kathmandu Valley. Nepal's rapid population growth exacerbates its earthquake vulnerability. With an annual population growth rate of 2.4%, the population of Nepal will double by the year 2019. The consequences for Kathmandu Valley are even more severe: rural exodus drives urban growth at an even faster rate, resulting in an urban growth rate of 6.5% and one of the highest urban densities in the world. Such growth increases earthquake risk in three primary ways:

- It strains the economy, diminishing available funding for education, research, public policy and regulation programs, which could reduce the seismic hazard.

- It necessitates rapid rather than sound construction, resulting in unplanned, unregulated buildings and inadequately engineered development.

- High population densities increase the raw number of people at risk and overwhelm emergency services.

The technical information about the earthquake risk in Kathmandu Valley is incomplete and scattered among several governmental agencies. However a more important contributor to the region's lack of

earthquake preparedness is that the technical information that is available has not been synthesized, has not been applied to the infrastructure of modern day Kathmandu Valley, and has not been presented in a form that the public and government officials can digest.

ADDRESSEING THE EARTHQUAKE THREAT

Earthquake risk is only one of many problems facing Kathmandu Valley and Nepal, but given the inevitability and disastrous consequences of a future strong earthquake, seismic safety must be incorporated into its development plan.

1. An estimation, using all information currently available, of the probable consequences of a repeat of the 1934 earthquake on modern day Kathmandu Valley. This will provide a factual basis for a sound public policy concerning earthquake safety.

2. A comprehensive set of earthquake risk management recommendations based on the expected consequences of a large earthquake which is developed by local and international specialists in government, city planning, urban infrastructure, and emergency services; and addresses the most significant aspects of the Valley's risk.

3. A properly constituted and equipped organization in which government, business and academic leaders collaborate to foster earthquake risk management and incorporate earthquake disaster mitigation strategies into Kathmandu Valley urban development process.

4. A demonstration project in which the earthquake risk of some critical, vulnerable element of society is reduced. Such a project should not only accomplish a tangible improvement (to leave something more than reports and organizations), but also contribute to the training of local people.

The Kathmandu Valley Earthquake Risk Management Project (KVERMP) has set the following objectives to address these needs:

1. Evaluate earthquake risk and prescribe an action plan for managing that risk;
2. Reduce the public schools' earthquake vulnerability;

3. Raise awareness of earthquakes among the public, Nepalese government officials, the international community resident in Kathmandu Valley, and influential organizations abroad concerning Kathmandu Valley's earthquake risk; and
4. Build local institutions that can sustain the work launched in this project.

Evaluating Earthquake Risk

Our first step will be to summarize the available information about the Kathmandu Valley's earthquake risk in a form that is understandable to public officials and the general public. The goal is not to develop a new, improved assessment of this risk, but rather to present what has previously been published about that risk in a form in which people who are subject to the risk and those who are responsible for managing that risk can understand. This comprehension is needed in order to organize a response to the earthquake hazard.

We will develop an earthquake risk map by superimposing the intensity of ground shaking experienced in the 1934 earthquake on the surface geologic conditions and the infrastructure of modern Kathmandu Valley, including roads; bridges; gas, water, sewer and electrical lines; critical government buildings; the airport; schools; and hospitals. We will also write a summary of the earthquake risk of the Kathmandu Valley. What is known about future earthquake (size, location, and repeat times) and the growth of the urban environment in Kathmandu Valley will be described.

For the purposes of the earthquake scenario (described below), we will concentrate on estimating the effect of a repeat of the 1934 event. One of our reasons for choosing an actual earthquake is that experience has shown that lay people are better able to envision what the effects of a repeat of an actual event will be on their city than the effects of a hypothetical event. Another reason is that, while seismology can be used to estimate the effects of a hypothetical event, taking into account magnitude, rupture dynamics, path attenuation and near-surface geology, these estimates are subject to debate. By using the observed ground motions of a past event, we can avoid a debate over seismological details and concentrate on improving earthquake

preparedness. Finally, this approach is taken because it is felt that the effects of the soft surface geology in the Kathmandu Valley will mean that the *relative* pattern of intensity will be approximately the same for all distant earthquakes. In short, we think that envisioning what would happen to modern-day Kathmandu Valley if the 1934 event were to be repeated is the best means to envision what will happen during the next significantly destructive earthquake. In all probability, the next earthquake to severely damage Kathmandu Valley will not be an exact repetition of the 1934 event. However, it is quite reasonable to assume that the next large earthquake to affect Kathmandu Valley will have the same relative shaking pattern within the Valley.

We will use the earthquake risk map in our interviews with the operators of critical facilities in the Kathmandu Valley. The interviewers will explain the overall earthquake risk of Kathmandu Valley to the person being interviewed. Part of this presentation will be an explanation of an earthquake risk map, which will show the level of shaking experienced in 1934 at the location of the operator's facility. The interviewers will ask what the expected consequences of such shaking would be, and will determine the level of preparedness in each facility to respond to an earthquake.

Presenting Earthquake Risk

After all the interviews are complete, a workshop will be held in Kathmandu. Government officials, business leaders, and community representatives in Kathmandu Valley will be invited to participate. These groups will include people who are responsible for the operation of important facilities or are responsible for responding in emergencies. In addition, a few international experts will be invited to attend who have similar responsibilities in other communities and who have actual experience during damaging earthquakes.

The workshop will have two products:

An earthquake scenario for Kathmandu Valley that is supported by the workshop participants

A list of suggested activities to reduce Kathmandu Valley's earthquake risk

The first product of the workshop will be an earthquake scenario, namely a description of the possible consequences of a repeat of the 1934 earthquake. This scenario will be created during the workshop with the help of a professional facilitator. The facilitator will use the information that has been assembled in the earthquake risk map and collected during the interviews to enlighten the workshop participants about the potential affects of an earthquake and to guide the participants towards consensus on a scenario of events.

The second product of the workshop will break into small groups based on areas of interest and/or expertise. Each group will suggest possible methods to address the risk that faces Kathmandu Valley. International experts and local specialists will guide these discussions and present techniques that have successfully reduced earthquake risk elsewhere in the world. All suggestions will be compiled into one list that will act as the basis for determining an action plan for Kathmandu Valley.

Creating an Action Plan

At the completion of the workshop, individuals will be selected to create an action plan for Kathmandu Valley in conjunction with NSET. The selected group should represent the major stakeholders in Kathmandu Valley. In June of 1998, NSET will officially adopt an action plan for reducing Kathmandu Valley's earthquake risk. This action plan will include a small number of items that are politically, financially, and technically feasible. This action plan will be adopted during a meeting with a professional facilitator. NSET will review annually what progress has been made towards the goals of the action plan, assess the reasons when progress has not met expectations, and write a report for public consumption. In this way, we expect that NSET will begin to establish itself as a 'watchdog' of seismic safety programs in Nepal.

SCHOOL SAFETY DEMONSTRATION PROJECT

This activity aims to begin the process of reducing the vulnerability of one element of Kathmandu Valley. It will produce tangible

results (retrofit schools) as well as education of earthquake risk and training. Schools were selected for this demonstration project because of their importance in the community and their potential for use as post-disaster shelters.

The first step of this activity is to classify the schools in the Kathmandu Valley according to earthquake vulnerability. There are almost 2000 schools in the Kathmandu Valley, one-third of which are private and two-thirds of which are public. Each school comprises 1-4 buildings.

There is neither sufficient time nor money to perform a complete structural evaluation of all these schools. We have decided to instruct the headmasters how to complete a survey that will allow an approximate classification, and this classification will be checked with a more thorough examination by a structural engineer of a sample of ten percent of the schools. This procedure will be affordable and will raise the awareness of the headmasters.

The survey forms will be an adaptation of existing forms used by the Building Department. These forms will be simplified and illustrated so that headmasters can fill them out. The survey will determine such parameters as: the number of age of the student body; the number of teachers and staff; the number of buildings, their age, the number of floors, their dimensions, construction materials, and construction systems.

There will be a series of 20 seminars over a period of 2 months for the headmasters of each of Kathmandu Valley's schools. Each seminar will be attended by about 100 headmasters and will last an entire day. The seminars will consist of 3 segments. The first will be an introduction to earthquakes, earthquake risk, and Kathmandu Valley's earthquake risk. The second segment will explain this project's school-related activities. The third segment will describe a questionnaire that we will request each school headmaster to complete (with the help of his associates) to evaluate the structural and non-structural vulnerability of each school. Educational information will be distributed for the school headmasters to share with their teachers and students. They will be encouraged to include this material as part of the curriculum. The headmasters will be requested to complete the questionnaire after explaining the project to the school teachers.

After the seminars, we will collect the complete questionnaires and enter the answers in a database. This information will be evaluated, with the help of local structural engineers, to assess the overall vulnerability of the school buildings in the valley.

In order to measure the reliability of the survey results, approximately 10% of the schools will be visited by a structural engineer who will make his own determination of the vulnerability of the schools. His determination will be compared with those made by the Headmasters, using the simplified surveys.

A local structural engineer trained in retrofitting buildings will evaluate several representative examples of the predominant school building types. This examination will coincide with the field verification of the survey form. Local and international experts will work together to design conceptual retrofit solutions for each of the predominant structural types of schools. Costs for each type of solution will also be estimated. This work will allow a reasonable estimate to be made for the cost in money and effort for making Kathmandu Valley's schools earthquake resistant.

Three schools will be selected, one in each of the major municipalities, that are of typical construction and that face high risk from earthquakes. Only schools that have a financially feasible retrofit solution will be chosen. A local engineer will make detailed retrofit designs for these three schools. International experts will verify these designs.

Funds will be raised to retrofit the three example schools. Funds for the construction of the retrofits are expected to come from the local municipalities and the international donor community. The actual construction of the retrofits will be outside of the scope of this project, but it is strongly believed that preparing the retrofit designs will motivate the community to complete the construction process. This project will provide advice and supervision during the construction process to ensure that the retrofit designs are applied properly.

Proposals will be written based on the evaluation of the vulnerability of the Valley's schools and the recommended retrofit solutions. It is estimated that approximately 1000 schools will need retrofitting (most of the private schools

are in rented structures, and therefore probably would not be interested, initially, in paying for retrofitting.) Assuming two buildings per school, this means that 2000 buildings would need retrofitting. Based on experience in other cities of developing countries and on limited experience of retrofitting in Kathmandu Valley, it is estimated that the average retrofit cost would be \$10,000 per building. Thus the entire school building stock, protecting the student body and teachers and ensuring emergency response centers would cost only \$40 million. While \$40 million is not an insignificant amount of funding, we believe that by proposing that the cost be divided among several donors, successful proposals can be written.

The proposed project – of retrofitting some 2000 school buildings – would have long-lasting, widespread effects. It would not only increase the safety of the next generation and provide emergency shelter for displaced persons. It would raise the awareness of the public of earthquake-resistant construction. It would give an opportunity for training a generation of masons, construction managers, and inspectors on proper construction techniques. It would provide a chance to implement the recently developed building code. The training of the tradesmen could, with proper incentives, influence the construction of new structures and the retrofit of other critical structures throughout the valley.

In addition to addressing the structural safety of Kathmandu Valley's schools, the project will include additional information about earthquake in the school curriculums. Currently, the Kathmandu Valley school curriculum includes a chapter about the nature of earthquakes, but there is no treatment of earthquake preparedness or earthquake vulnerability. We have spoken to teachers in the Kathmandu Valley who welcome the idea of expanding the present curriculum to include earthquake preparedness. The idea is to teach something of the danger created by earthquakes and the steps one can take to reduce that danger. In the course of this project and in collaboration with a teacher we will prepare a draft of an addition to the curriculum. The draft curriculum will be distributed to the schools as a trial, feedback will be obtained, a revision will be

written and the final text will be submitted to the Ministry of Education for inclusion in the next textbook printing.

PUBLIC AWARENESS

The purpose of this element of the project is to raise awareness of the earthquake risk facing Kathmandu Valley among Nepalese (including government officials, government administrators, influential members of the private sector, and the public) and among non-Nepalese (including foreigners living in Kathmandu, international donor organizations, and international earthquake professional societies). Raised awareness will provide the fiscal and political support necessary to reduce the risk.

The major activity in raising earthquake awareness will be to establish that every January 15 is designated as Kathmandu Valley earthquake day, in recognition of the occurrence of the last earthquake tragedy to strike the valley, which occurred on January 15, 1934. The first celebration of this day will be at the end of this project, January 15, 1999. On this day, activities will be organized at pre-designated open areas, where citizens would collect after a future earthquake.

One of the mainstays of earthquake response plans of most densely populated cities is use of pre-designated open areas where survivors can gather. In some cities the playgrounds of public schools are designated as such areas. In Kathmandu, however, many schools do not have playgrounds and are now surrounded by other buildings. After the 1934 earthquake, survivors did gather in open areas, but most of these areas are now filled with houses. One of the purposes of this activity is to have local authorities designate for the first time emergency response open areas, to inform citizens of their locations, and to train them to go to these areas in case of emergency.

On Kathmandu Valley Earthquake Day, there will be displays in the open areas explaining some common aspects of earthquake risk in Kathmandu Valley. There will also be information booths to dispense information about non-structural hazards in the home and work place, and what to do in case of an actual earthquake.

All school children will march from their schools (most of which do not have open areas adjoining them) to these open areas to be present at 2:00pm, the time of the 1934 event. The marching of the students will be highly visible to other citizens and should attract attention to the activities in the pre-designated open areas.

The project will be requesting the different ministries and departments of His Majesty's Government of Nepal, as well as the municipalities, the village development committees and the communities for cooperation, participation and patronage.

Once this annual event is firmly established, it can be extended to other major towns in Nepal, recognizing that the majority of Nepalese live outside Kathmandu and are also subject to great earthquake risk. Some of the written materials developed for the Kathmandu Valley Earthquake Day may be appropriate for use outside the Valley, but new material will have to be developed to address rural conditions.

INSTITUTION BUILDING AND TRAINING

The Municipality of Kathmandu City has indicated a desire to establish an office of Disaster Management. It has funding to create this office, but needs advice on how this office should be organized and staffed. This project will provide that advice, by sending an experienced emergency response official from the US to consult for one week. Representatives of Lalitpur and Bhaktapur have also expressed similar desire. They will also be invited to attend the training provided to Kathmandu City, in the hopes that these cities may also see the need to create such offices.

Grant-writing awards

This project has allocated funds to support the writing of 10 proposals to address the earthquake vulnerability of privately owned buildings. After the workshop in which an Action Plan has been developed, NSET will announce a contest for the best ideas for proposals to reduce the vulnerability of privately owned buildings. People will be invited to submit short (e.g., 3 page) descriptions of their ideas. A committee of experts selected by NSET will choose the 10

ideas judged to have the best chance to be funded (members of the committee will not have connections with the winners). NSET will provide a total of \$400 to each winner to support the more elaborate process of writing a complete proposal for submission to international donors (\$200 will be awarded initially, and the remaining \$200 when the completed proposal is accepted). NSET and GeoHazards International will provide advice to assist in the writing of the proposals.

The National Society of Earthquake Technology of Nepal (NSET)

Another focus of our institution-building activities will be the NSET, which is the national member of the International Association for Earthquake Engineering. It is developing as the depository of information on earthquake engineering and earthquake disaster management in Nepal. The Society will play increasingly important role in the **Urban Disaster Mitigation Network**, which AUDMP/ADPC has endeavoured to establish.

National Disaster Management Training

The project will fund the attendance of approximately 10 Nepali locals to the national training program(s) proposed to be conducted by Nepalese training institutions in Nepal. Asian Disaster Preparedness Center (ADPC) will be assisting Nepalese training institution(s), as part

of the Asian Urban Disaster Management Program (AUDMP), to develop capabilities in conducting training programs in aspects of disaster management. Earthquake, Flood and Landslide are likely to be the hazards together with general disaster management as courses to be offered in the program. It is expected that at least one of such programs will be conducted during the project period. NSET will be assisting both the ADPC and the Nepalese training institutions in the selection of the candidates to the training program and by providing resource persons.

The Project expects to raise funds from in-kind contributors to this project for sponsoring participation of 10 more individuals for this training program.

PROJECT MANAGEMENT

Overall review of this project will be provided by an Advisory Committee and two sub-committees, which will meet regularly throughout the following 18 months. The Advisory Committees consist of the Management Committee of NSET and representatives of government and non-government organizations, international donor agencies, municipality mayors, and the mayors of sister cities. The advisory committees will be the forums for addressing suggestions and critiques of the project.

Tsho Rolpa Glacier Lake

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Tsho Rolpa Glacier Lake is situated at the source of the Rolwaling Khola in the Rolwaling Valley, a tributary of Tama Koshi in the Dolkha District of Nepal. The detailed and long-term investigation of the Tsho Rolpa Glacier Lake was started in 1993 and (the present author) considered as a model lake for study and mitigation. Based on available maps, satellite imageries, field surves, the development of this lake was studied.

The lake has developed from 0.23 sq km (1959) to 1.39 sq km (WECS, 1994). It can be concluded that the rate of area increase has been accelerated. The present maximum depth of the lake is 132 m (WECS, 1993) and the stored water volume is 76.6 million cubic meter (WECS, 1994). The deeper portions are closer to the glacier. The average depth is about 3 km long and about 0.5 km wide. The lake water level is about 4580 m from mean sea level (about 4550 m asl in FinnMap).

The lake is dammed by moraine (ice-cored-moraine) formed during the advancing phase of Trakarding Glacier during the last glaciation 'Little Ice Age' (approx. 1550 to 1850 AD period). Rakarding Glacier, the main stream of the confluent valley glacier system in the area started retreating actively around 1950AD. The Tsho Rolpa Glacier Lake gradually developed dammed by the unconsolidated moraine and with some dead ice left behind by the glacier while retreat. The Tsho Rolpa Glacier Lake might have started forming around 1950 AD. The end moraine is about 150 m from the dam crest to the toe at the Rolwaling Khola. (The base width at the dam is estimated at least half a kilometre wide). Few islands are there at the lower part of the lake nearer to the end moraine (or as the part of end moraine). The presence of thick dead-ice-mass at a depth of 5 to 10 m under the lake bottom near end moraine is reported. The ice-mass also does exist just near the surface at the end moraine only 4 to 6 m in depth (WECS, 1995). The deepening (bottom sinking) rate of the lake near the island is reported 25 cm per year.

There are seven leakage points reported from the outer wall of the end moraine dam, three at right bank and four at left bank of the outflow. The leakage points are about 50 m below lake level. The lake is frozen during the mid winter period. The minimum discharge recorded at the outlet is 0.05 cubic meter per second (12 March 1994), 0.09 cubic meters per second (23 March 1995), and the maximum discharge at the outlet recorded is 19.0 cubic meter per sec (17 July 1993), 16.4 cubic meters per second (2 July 1994). The annual amount of lake discharge calculated is 95.5 million cubic meter which corresponds to the average discharge of 3.03 cubic meter per sec.

The discharge at the outlet on 14 June 1993 is 3.12 cubic meter per sec, at Naa (at 4183 m asl elevation and 4 km downstream from the lake) on 17 June 1993 is 14.12 cubic meter per sec, at Bedding (at 3693 m asl elevation and 10 km downstream from the lake) on 19 June 1993 is 27.14 cubic meter per sec. At most of the upper part of the Rolwaling Valley is wider and the lower parts are narrow as well as steeper. From the lake (4580 m asl) to the Rolwaling Khola junction with Tama Koshi at Chetchet

(1380 m asl) is about 26 km, and to the Khimti Khola junction with Tama Koshi (590 m asl) is about 75 km. Tama Koshi downstream from Rolwaling Khola confluence is wider and gentler in slope.

The tongue of the debris covered Trakarding glacier in contact with the lake seems very thick. There exists several supra-glacier-ponds at the Trakarding glacier and most of them are drained into the lake. There are several cracks at the tongue of the glacier. The glacier is retreating relatively fast. And the glacier retreat rate is about 100 m per year. The lake volume is increasing every year due to glacier retreat, deepening of the lake, narrowing of the damming moraines. Looking at the present day lake development and comparative studies with the other similar glacier lakes in the Himalaya, the Tsho Rolpa Glacier Lake is definitely a potentially dangerous lake as the source of the glacier lake outburst flooding.

The study of the glacier lakes in Nepal started since 1985 by WECS/HMG-N with the support of CIDA (WERDEP, WISP) until 1996. The first professional field investigation of the Tsho Rolpa Glacier Lake was carried out voluntarily for the Netherlands-Nepal Association of Amsterdam by Dr. Michel Damen of ITC, the Netherlands in 1992. In 1993 the detail study of the lake and the Rolwaling Valley under the WECS was initiated. Technical and some financial supports were also made available by JICA from 1990 to 1996 for the study of glacier and glacier lakes in Nepal. A test siphon system at the lake were provided by WAVEN Company of the Netherlands through the effort of the Netherlands-Nepal Association at Amsterdam, and installed at the site successfully in 1995 to test the materials and design mechanisms. That was followed by a assurance from the Netherlands Government for the financial support for the mitigation work at the lake. The Netherlands fellowships to six Nepalese students were provided in 1995/96 to carry on the postgraduate diploma course on the possible glacier lake outburst flood hazard study in Rolwaling valley. Furthermore, two similar fellowship were provided to Nepalese in 1996/97 for MSc course at the Netherlands for glacier lake studies in Nepal. In 1996 JICA support for the study of the lake in Nepal was terminated.

During the period 1993 to 1996, several professionals and students from different countries studied the Tsho Rolpa Glacier Lake. Much attention were focused during 1997 summer on the national and international level to the Tsho Rolpa Glacier Lake.

It is very difficult to predict the level of danger and forecast how and when the outburst of the glacier lakes will take place, without detailed multi-disciplinary investigations of the total environment of the lake and associated surrounding features in total. We are certain that the Tsho Rolpa Glacier Lake will burst out in future, but it is not yet understandable about the detail mechanism of possible failure and exactly when will that happen. Detailed, careful and continuous monitoring of the lake is very important right from now on. Suitable mitigation measures must be taken quickly. Any mitigation measure to be taken in near future must be very carefully planned so that no artificial/manmade triggering factor create the outburst and ultimately uncontrolled hazard. The remoteness, harsher terrain conditions, limitation of other physical and technical factors need consideration

while implementation of the mitigation works.

The early warning system, timely public awareness and initiation of some mitigation activities undertaken during the summer of 1997 by the Ministry of Home Affairs of His Majesty's Government of Nepal is appreciable. It is recommended for more coordination and planning for the effective technical and management to conduct the careful and timely implementation of the mitigation works.

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Disasters in Butwal, western Nepal

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ABSTRACT

As one of the youngest mountain in the Himalyas, the Siwaliks severely suffers from potential landslides, debris flow, rock falls, erosion, etc. and therefore considered as a disaster prone zone. The geology of Siwaliks is fragile, which certainly demands appropriate attention for environment-friendly design in any development activities. It can hardly be believed that any infrastructures could last for long when the area is governed by unstable geological structures. Natural forces as well as human interventions have been the major factors which have induced disasters.

A huge landslide at right bank of the Tinau River at Butwal destroyed a reinforced concrete bridge in 1978. The slide occurred in the rocks with the intercalated sequence of sandstone and

mudstone. This area is located near the Main Frontal Thrust (MFT).

This papers outlines the existing fragile situation in the city of Butwal and suggests some possible mitigation measures.

INTRODUCTION

The city of Butwal, situated on the alluvial fan of the Tinau River is surrounded on three sides by gently sloping hills of the Siwaliks (Churia range) and Terai plain lies to the South. After a week of an incessant rains, a huge landslide occurred in 1978 on right bank of the Tinau River, destroying a NRs. 5 million worth reinforced concrete bridge, which linked the East-West Highway. It is worth mentioning that this bridge was destroyed even before it was

officially inaugurated. A new bridge has now been relocated about 800 m downstream from the destroyed bridge (Plate 1).

Apart from the landslide (1978) that destroyed the bridge, some other disasters that have occurred in Butwal are as follows:

- In 1970 (2027 BS), a huge flood in the Tinau River swept away many lives and property. The intense flood was due to the damming of the river few kilometers upstream.
- In 1981 and 1986, flash floods occurred in the Ghuhe Khola, west of Butwal causing severe damage to lives and property.
- A debris flow occurred in 1986 in north of the Butwal Multiple Campus resulting in temporary relocation of the population.
- The landslide triggered in 1991 near the confluence of the Sahasra Stream and the Tinau River, poured huge volume of debris into the Tinau River. This area is still prone to landslide damming.

GEOLOGY AND FACTORS CAUSING LANDSLIDES

An active fault, the Main Frontal Thrust (MFT) runs along the southern most foot-hills

of the Churia Range and divides it from the Terai Plain to the south. The fault passes very close to Butwal. The rock sequence comprises of sandstone and mudstone. The rocks were deposited in the process of the Himalayan upheaval.

Recent terrace deposits are also observed on the southern extension to the east and west part of the city. The entire terrain to the west and east of the Tinau river is an ancient landslide. It can be seen as an irregular shaped hill with bulge and steep scars. New scars are developing rapidly in the area and are now on the verge of failure.

Most of the landslides were a reactivation of old landslides mantling the old scarp. A study conducted in the area has shown that the varied and fragile rock conditions, severe deforestation and the ground water were the main factors that caused the landslide. During the construction of the road the toe of the hill was cut and the unstable zone lost the lateral support. During the heavy rainfall water percolated through the weak and fragile rock and saturated the thick bed of mudstone which developed pore water pressure triggering the failure.

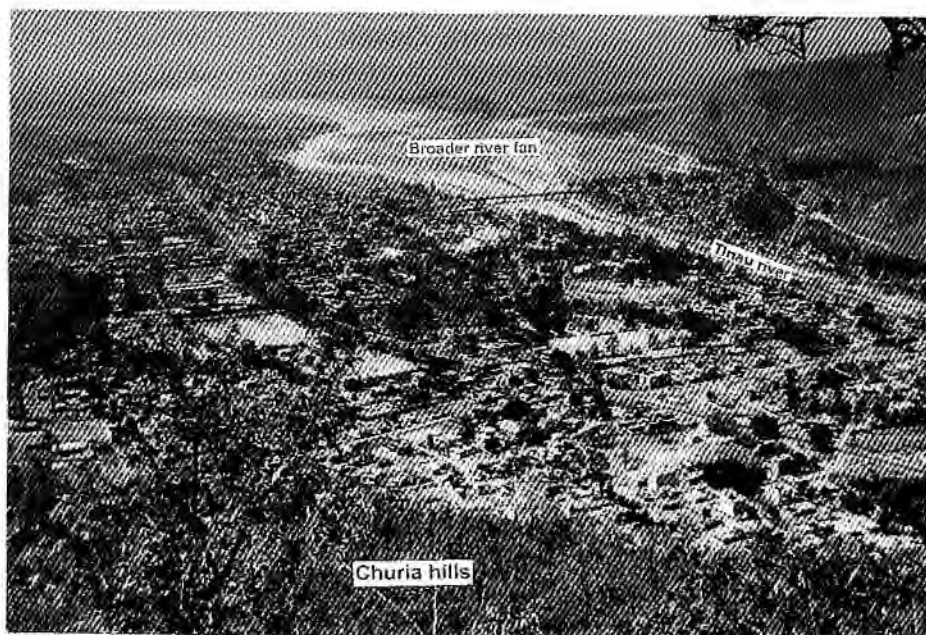


Plate 1: City situated on the alluvial fan of the Tinau River and the Southern most foot-hill of the Churia range. View of the relocated bridge. View toward SSW.

PROPOSED MITIGATION MEASURES

The number of slide prone area mostly at the foot hills causing severe problems are mainly due to water seepage. On priority basis those hills are to be treated for slope stability.

Groundwater should be drained out through horizontal drain holes, before the water gets down into the bottom and moving along the slip surface. The drain holes of about 35-50 mm diameter can be drilled with the help of handheld pneumatic drill hammer; and then perforated HDP pipe could be installed

The rock slide occurred in the intercalated sequence of mudstone and sandstone on the way from Butwal to Tansen (Plate 2) need to be



Plate 3: The rock slide in the intercalated sequence of mudstone and sandstone. View toward NE.

treated for stability. The mudstone layers get easily eroded by rain and the blocks of sandstone remain hanging and can fall anytime. Those weaker layer are to be protected first with shotcrete (sprayed concrete) application with provision for weep holes.

Since the area possesses numerous old landslides, shallow-seated instability and erosion on slopes are common. The new scars have been formed every monsoon which are later reactivated and trigger landslides. The scars are frequent in the southern parts of the Churia hills. The bio-engineering methods would be quite effective to reduced such risk of slope instability.

The farm land at the southern part of Butwal is vulnerable to river scouring (plate 1). The river is eroding those land every year. The Tinau River need to be trained (plate 1).

There are three major streams in the west of Butwal that transport huge volumes of debris. Being steep, intense floods have always been threats to the residents. Number of check dams need to be constructed across the width of the steep channels to control the debris and floods.

CONCLUSIONS AND RECOMMENDATIONS

The area lies in a geologically weak zone and therefore suffers from various disasters. Due to water percolation during the monsoon seasons slope failure can be triggered. Since the area consists of ancient landslides, any constructional disturbances may cause potential slope stability problems.

Consideration should be given for slope stability for any kind of engineering structures at this area. Hazard maps of the area should be prepared and the hazardous slopes should be monitored. The settlement in high hazard zones should be relocated to safer places.

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INTERNATIONAL DECADE FOR NATURAL DISASTER REDUCTION

Training cum Workshop on Natural Disaster Reduction (9-10 December, 1997)

To commemorate the International Decade for Natural Disaster Reduction (IDNDR) Day - 1997, Nepal Geological Society in collaboration with HMG/Ministry of Home, UNDP/Nepal, Lutheran World Service/Nepal and National Society of Earthquake Technology (NSET) organised

the Inaugural session was chaired by Mr. C.S. Basnet, Joint Secretary, Ministry of Education. In the beginning of the programme, Dr. B.N. Upreti, President, Nepal Geological Society delivered the welcome speech and highlighted on the



Participants listening to a lecture during the Training cum Workshop

a short Training cum Workshop on Natural Disaster Reduction to the Highschool Teachers of Kathmandu Valley in the auditorium of Nepal Administrative Staff College on 9-10 December 1997. The training was participated by 90 teachers from High Schools based in Kathmandu, 7 officers from Ministry of Education and 3 personnels from Municipalities.

The workshop was inaugurated by Dr. C.K. Sharma, Academician, RONA and

objective of the training. Dr. C.K. Sharma, Chief Guest and Mr. Basnet, Chairman of the session expressed their feelings and appreciated the programme organised by Nepal Geological Society.

Inaugural session was followed by the lecture session. Dr. B.N. Upreti was the first lecturer who delivered a lecture on Introduction to the Physiography and Geology of the Nepal Himalaya. It was followed by another important lecture by

Mr. J.K. Shakya, Joint Secretary, Ministry of Home, on Disaster Management in Nepal. In the afternoon session, Dr. M.R. Dhital, Lecturer, Central Department of Geology, Tribhuvan University, gave a lecture on Landslide Hazards and its Mitigation in Nepal and P.K. Mool, Geologist, ICIMOD delivered a lecture on Glacial Lake Outburst Flood (GLOF) disaster in Nepal.

The next day on 10th December in the Morning session Mr. G.R. Chitrakar, Geologist, Department of Mines and Geology gave an introductory lecture on Earthquake Seismology and Seismological Studies in Nepal. It was followed by a lecture by Mr. M. Nakarmi, Member, National Society of Earthquake Technology, presented a review on Historical Earthquake in Nepal and Disaster Management. In the

Afternoon session, Mr. A.M. Dixit, Engineering Geologist and Secretary NSET delivered a lecture on Earthquake Disaster Mitigation Programmes in Nepal. Mr. Bimala Rijal, Lutheran World Service/Nepal delivered a lecture on Developing School Earthquake Safety Programme. During the training slides and documentary films related to various types of hazards, and their effects were also shown to the participants.

At the end of the Training, participants expressed their feeling and extended their thanks to Nepal Geological Society and other organisation who took initiation to organise this valuable programme. Within two days time, they learned many interesting geological phenomena and their effects. They were highly benefited from this training. Such training should be organised regularly.

***Best Wishes and
Hearty Felicitations
on the occasion of
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GPO Box 1192, Kathmandu

Second Nepal Geological Congress

11-13 November, 1997

Kathmandu

The Nepal Geological Society successfully organised the Second Nepal Geological Congress in Kathmandu from 11-13 November, 1997. The Chairman of the National Assembly (Upper House of Parliament) of Nepal, Rt. Honourable Mr. B.B. Karki inaugurated the Congress. In his inaugural speech, the president of the Nepal Geological Society and the convenor of the Congress Dr. B.N. Upreti pointed out the very limited opportunities available for interaction among the geoscientists of this region due to lack of forum for regular meeting and sharing of scientific knowledge and research findings. He expressed the view that regular organization of congress like this will greatly help geoscientists of this region to bring closer together.

During the inaugural programme, Mr P.B. Malla, former Director General of Bureau of Mines and the first mining engineer of Nepal, was awarded the Honorary Membership of the Nepal Geological Society. This honour of the Society is given to any distinguished geoscientist who has significantly contributed to geoscientific research in the Himalaya and the adjacent regions. Previous recipients of this honour were the late Professor P. Bordet (France) and the late Dr. C.K. Sharma (Nepal).

The Congress was participated by 250 geoscientists from 11 different countries (namely Austria, Bangladesh, Canada, China, France, Germany, India, Japan, Nepal, Pakistan, and USA). A total of 125 abstracts were received which were edited and published in the special issue of the *Journal of Nepal Geological Society*

(vol. 16). The Congress sessions were divided into (i) regional geology and tectonics, (ii) hydrogeology, (iii) economic geology and (iv) geomorphology, engineering geology & environmental geology.

There were 76 oral and 7 poster presentations in the Congress. Two keynote papers were also presented. The first was by Dr. S.K. Acharya, Director General of the Geological Survey of India on the "Role of Tectonics and concealed Tertiary foreland rocks in formations of domes in eastern Himalaya and eastern syntaxis" and the second was by Dr. R.P. Bashyal, Deputy Director General of the Department of Mines and Geology, Nepal on "Petroleum exploration promotion in Nepal."

A post-congress geological field excursion was organised from Kathmandu to Kodari (Nepal-China border).

In the concluding session, Dr. Aftab A. Butt, Professor, Institute of Geology, Punjab University, Pakistan, Mr. S.K. Acharya, Director General, Geological Survey of India, Dr. Fazlul Karim, Bangladesh, Dr. K. Arita, Professor, Hokaido University, Japan and Dr. C.F. Uhlir, Austria and representative from China expressed their feelings about the Congress. They congratulated to the NGS for successful completion of the Congress and extended their thanks to the organiser. At the end Dr. B.N. Upreti presented his concluding remarks. He proposed to hold HKT International Workshop in Kathmandu, Nepal on the occasion of 25th Anniversary of NGS in 2004.

Welcome Speech by Dr. B.N. Upreti, President, Nepal Geological Society

**Respected Chairman of this Inaugural Session Dr. Bhola Nath Chalise,
Respected Chief Guest Rt. Honourable Mr. Beni Bahadur Karki,
Chairman National Assembly;
Mr. P.B. Malla, former Director General of Bureau of Mines
Distinguished Participants;
Fellow members of Nepal Geological Society;
Ladies and Gentlemen!**

It gives me extreme pleasure to welcome you all this morning to the inaugural ceremony

of the Second Nepal Geological Congress and the presentation of the award of Honorary Membership of the Nepal Geological Society. To all the participants from our friendly countries- warm welcome to Kathmandu and to this congress.

In August 1995, little over two years before, Nepal Geological Society had organized the First Nepal Geological Congress to observe the 15th anniversary of its establishment. Subsequently it was decided that the congress should be a regular event of the Society. This Second congress is thus the continuation in this series.

We will now continue to organize this congress in every two to three years interval in future also.

I may mention here that the Nepal Geological Society is more than just a national Society. It has over one third of its members from this region and overseas. In addition to the Nepalese Members, in fact, many of the participants who are present today in this hall coming from various countries are the members of Nepal Geological Society. We are thankful to all those members and very much appreciate for their goodwill and support to the Nepal Geological Society by way of attending this Congress.

Mr. Chairman,

Today we live in a so called global village. But it is a matter of concern that we geoscientists particularly of this region are very much confined in ourselves, and adequate interaction and forum for regular meeting and exchange of scientific knowledge and research findings are very limited. We believe that congress like this will definitely help to break this barrier and bring together the geoscientists of this region. Science can only grow with the regular sharing of information and knowledge. Today, the concept of regional cooperation is catching up. I think we the geoscientists should also take this opportunity and expand our grounds of cooperation and interaction at our own levels and through the governments.

We are so pleased to find that there was such a good response to this Congress from the geoscientists of this region and overseas. We have received over 125 abstracts for the presentation in the congress from nine different countries (namely Austria, Bangladesh, China, France, Germany, India, Japan, Pakistan and Nepal). We have over 200 participants in this congress including Nepalese participants. The technical sessions will run for three full days with parallel sessions. The papers presented in the congress will be published in the Proceeding of the Congress as a special Issue of the Journal of Nepal Geological Society and will come out by November 1998.

During the organization of this congress, we have received tremendous support and

encouragements from many national and international organizations, universities and government organizations. I am extremely thankful to all those universities, Geological Surveys, Science academies and Research Institutes who took care to circulate the first and second circulars and supported their scientists to send to this Congress. I am thankful to all those institutions for this help. ICIMOD (International Centre for Integrated Mountain Development) kindly provided some fund to support candidates from HKH countries, without whose support we could not have invited many of our foreign participants present here.

Various organisation of his Majesty's Government of Nepal, namely Department of Mines and Geology, Department of Irrigation, Water Induced Disaster Prevention Technical Centre (DPTC), Nepal Electricity Authority, Tribhuvan University have extended their full support in all respects without whose support this congress would not have been possible to organise at this scale. We are very much thankful to them.

For all this said, this congress would not have been possible without the generous financial support of many national, international consulting and construction companies, the list of which you will find in the abstract volume. It gives me great pleasure to mention here that despite their limitations, the consulting companies have always come forward to help Nepal Geological Society in every occasions when we have approached them.

Nepal Geological Society is a volunteer organization. It is a small society with very limited resources. There are no paid staff of its own. We have tried to organize this congress to the best of our ability and resources. There may have been shortcomings in many ways. I hope you will forgive us for these shortcomings.

The three days of the congress is going to be hectic, as there are about 70 oral presentation. Though we did not like it, we had to make parallel sessions to complete the oral presentation. We also had to limit to only one oral presentation for one participant. I hope we will bear with us this rather strict code.

Finally, once again I would like to extend a warm welcome to all of you and thank you.

Inaugural Speech by Rt. Honorable Mr. Beni Bahadur Karki, Chairman of National Assembly

**Mr. Chairman,
Distinguished Scientists from Friendly
Countries
Participants to the Congress
Ladies and Gentlemen**

It is a privilege for me to be invited to the **Second Nepal Geological Congress** and given the opportunity to inaugurate this important international meeting.

I congratulate the members of the Nepal Geological Society to have organized themselves with a commitment to use their knowledge in the task of national development. It is indeed a pleasure to know that you have been able to bring together scientists from SAARC region and other countries in order to devote the synergy in the geological researches of the Himalayas. It is wonderful that there has been established a tradition of international cooperation and joint efforts in uncovering the geological mysteries of the Himalayas, in revealing and developing the mineral and water resources of the region, in establishing the geological control of the environment, in uncovering the cause-effect relationship between the geological conditions and the occurrences of geological hazards. The network it has established makes it look like an international center giving opportunities to the Nepalese geoscientists to effectively communicate with their counterparts from other countries. It is highly commendable that the Nepal Geological Society has been publishing a scientific journal and a News Bulletin, which have worldwide circulation. This is a substantial achievement for the scientific community of a country, which is faced with a multitude of problems including a tremendous lack in resources.

His Majesty's Government of Nepal attaches high importance to such contribution of the Nepalese geoscientists in geological mapping and mineral exploration, environmental studies and mapping of natural hazards such as landslide, debris flow and earthquake, in utilization of water resources of the country and in educating and training young Nepalese by preparing appropriate training curriculum of study in the university, and in raising the general awareness

on the importance of geology in the task of national development. Thanks to the geoscientists of this country, we in Nepal are applying the knowledge of geology in the planning, design and implementation of infrastructure projects such as dam, road, irrigation, hydroelectricity, water supply, town planning, and exploitation of mineral resources and construction materials such as limestones, marbles and slates. Similarly, the Nepalese geoscientists are contributing to the country much not only by their researches on natural hazards such as earthquakes, landslides, Glacier Lakes Outburst Flood but also by their recommendations for a sound and economic design for their effective mitigation. We in Nepal have been utilizing extensively the geological knowledge in the management of environmental protection works, as geological conditions constitute one of the main components of Himalayan Environment.

His Majesty's Government of Nepal will continue looking to the earth scientists of Nepal for their help in the task of effective utilization of the mineral and water resources, in the mitigation of natural hazards, in the solution of environmental problems, in the task of infrastructure development. The government will do its best to assist this community in the development of professionalism, in facilitating regional scientific cooperation. At the same time I request the scientists gathered here to constantly remember their responsibility to accelerate the economic development of the country and help solve the problems of poverty.

I am sure that the deliberations during the days to follow will help you take yet another step closure to revealing the geological mysteries of the Himalayas, identifying the generalities of mineral occurrences in this region, unveiling the intricate relationship between the environment and geologic processes, in identifying the effecting means for the mitigation of natural hazards and safeguarding the infrastructure.

I hope that the brief stay of our foreign guest in Kathmandu will be comfortable and pleasant.

I thank the organizers again for giving this opportunity to be with you and share some of my feelings.

Citation to Mr. P.B. Malla

Respected Mr. Pushpa Bhakta Malla,

You are the first Nepalese mining engineer of Nepal. You also were the first Director of the Nepal Bureau of Mines in 1958. As a visionary, you started a reorganization process for the Nepal Bureau of Mines and contributed to its institutional and human resources development. By this, you initiated a scientific approach towards mineral exploration and geological survey of the country.

Under your able leadership, the Nepal Bureau of Mines could start the HMG-USA cooperation in mining/geology sector in the country. This comprehensive program was instrumental in the development of basic infrastructure (laboratories, library, etc.) and trained manpower. Likewise, you could plan and implement a comprehensive program of geological survey during 1954-1958 under a Nepal-India cooperation program. A major thrust in the search and exploration of minerals in Nepal was done during your tenure as the Director of Nepal Bureau of Mines. Thus you laid down the foundation of an institution, which has developed into what we see today as the Department of Mines and Geology.

As a professional, you contributed also in the development of many mineral deposits in Nepal. You were the main architect who carried out the ground works leading to the establishment of first cement factory in Nepal — the Himal Cement Factory at Chobhar in the southern part of Kathmandu. Similarly, you put your efforts in conducting the first technical appraisal of the limestone deposit of Bhaishendobhan near Hetauda under a Nepal-

India cooperation program. You are the author of the discovery of the important fossils of Phulchowki area south of Kathmandu, which was later described by Hon'ble Member of Nepal Geological Society, late Prof. P. Bordet. You carried out exploration of mica deposits, Phulchowki iron deposit, several lead and zinc deposits and copper prospect of Siddhi Khani which also evidence your contribution in the field of mineral resources development. The symbol of oil exploration in Nepal — the bottle of Dailekh oil sample in the premises of the Department of Mines and Geology at Lainchaur, Kathmandu was collected by you. You have also contributed in developing mining legislation leading to the process of awarding mining lease for commercial mining of mineral resources of the country.

As a patriot, with firm belief on the important role of mineral sector in national development, you continued serving the mineral sector as an operator of a stone quarry for nearly 20 years even after your retirement from government position.

Mr. Malla! You have always been a source of inspiration for the community of earth-scientists of Nepal. Nepal Geological Society is thankful to you for your continued assistance - despite your old age you always accepted the Society's request to lead scientific excursions to Phulchowki Danda to share your profound knowledge on the fossils and iron ore deposit there.

Nepal Geological Society feels honored to admit you into the college of luminaries of Honorable Members of the Society.

May God bless you a happy and long life.

सम्मानित सदस्य श्री पुष्पभक्त मल्लले सम्मानित सदस्यता प्राप्त गर्दा दिनुभएको मन्तव्य

सम्माननीय, माननीय, भद्र महिला तथा विद्वत वर्ग

यस भू-विज्ञान Geology विषय जीवनमा केही विशेष उल्लेखनीय श्रेयस्कर काम गर्न सकेको होइन तापनि Nepal Geological Society बाट खानी विभागको भूतपूर्व निर्देशक ८४ वर्षको बढी म पुष्पभक्त मल्ललाई

मान खातिर मानार्थ सम्मानित सदस्यता प्रदान गर्न शुभ निमन्त्रणा दिनुभएकोमा अत्यन्त आभार सहार्दिक धन्यवाद मानेको छु र सो आभार प्रकट गर्न दुई चार शब्द बोल्न यहाँहरू सबै उपस्थित विद्वत वर्गको सम्मति हुनेनै छ ।

हामी सबैको दृढ विश्वास भएको छ कि भगवानले संसार सृष्टि गर्नुभयो । भगवान नै सृष्टि, स्थिति र संहार गर्नु

हुन्छ । सृष्टि कसरी हुन्छ भन्ने कुरा भगवान नै जानिफकार हुनुहुन्छ । स्थिति कसरी भन्ने कुरामा विवेक विचार पुर्‍याई हेरेमा यो पृथ्वी नै स्थितिकर्ता भनुं या पालन पोषण गर्ने साधन हो भन्नुमा अत्युक्ति नहोला । मानिस मात्र होइन कीट, पतङ्ग, पशु पक्षी इत्यादि समेत बोट विरूवा सबै जीव यो पृथ्वीबाट नै जीवन निर्वाह गर्दछन् । जीवन निर्वाह यही पृथ्वीबाट भएको छ भन्ने कुरा हामी जीव मात्रको खान, पान, बास, कपासदेखि लिएर आजको सभ्यतामा हामीले देखेको सुनेको उन्नति, सम्पत्ति सबैको श्रोत पृथ्वी नै हो भन्ने कुरामा दुईमत हुनेछैन ।

यो पृथ्वीलाई हामी आमा भन्छौ । यहि पृथ्वीलाई अितिस, हिरण्यगर्भ, बसुन्धरा, रत्नगर्भ, मेदिनी, भूगर्भ आदि आदि शुभनामले पुकार्दछौ । यी नामहरू श्री विष्णु सहस्र नामावलि: मा उल्लेख छन् । यहि पृथ्वी विषयक ज्ञानलाई भूगर्भ शास्त्र Geology तथा Earth Science भनि आएको छ ।

गहिरिएर विचार गरेमा कृषि, वन, निर्माण, संचार, यातायात, विद्युत शक्ति, विज्ञान आदिको श्रोत पनि भूविज्ञानका अङ्ग स्वरूप हुन् भन्नुमा पनि अत्युक्ति नहोला । यहाँहरू भूगर्भशास्त्री, भूवैज्ञानिकहरू समक्ष यसको वर्णन गर्नु सूर्यलाई दियो बाली स्वागत गर्नुजस्तो हुनेछ ।

यस प्राकृतिक संसारमा हामी सबैको आधार भरोसा यस पृथ्वीभन्दा अरु कुनै महत्वको कुरा छैन । भगवानको सृष्टिलाई स्थितिलाई ल्याउने साधन धर्म, अर्थ, काम, मोक्ष, चतुर्भाव, चतुस्कर्म्म, चतुर्धर्म, चतुस्पुरुषार्थ, चतुश्चैत्यको आधार पनि वास्तवमा यही पृथ्वी नै हो ।

भूगर्भ विज्ञान नयाँ विज्ञान माने अरु वैज्ञानिक ज्ञानहरूको उन्नतिको आधारमा उन्नति हुन आएको भन्ने पनि कथन छ तापनि गम्भीर अन्वेषण गरी हेरेमा भूविज्ञान सबै विज्ञानको आमा भन्नु होस् वा श्रोत भन्नुहोस् या साधन भन्नुमा अत्युक्ति नहोला ।

यी सबै कुराको ज्ञान दिने विद्या नै हो र भनिएको छ:- "नास्ति विद्या समं चक्षुनाप्ति विद्या समं तपः ।"

यहाँ महान् अनुभवी वैज्ञानिकहरूको श्रम तथा शीपले नेपाल आमाको साथै पृथ्वी भरका प्राणी मात्रलाई उन्नति पथमा लगाउने श्रेय कर्ममा यो भूविज्ञान सदुपयोग गर्नुमा सफलता प्राप्तिको लागि हार्दिक शुभकामना छ ।

ज्ञाननै शक्ति, श्रमनै भक्ति र भक्ति नै मुक्ति

जय नेपाल, जय संसार ।

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*Best Wishes and Hearty
Felicitations*

on

The Auspicious Occasion

of

New Year 2055



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Geologist's expertise going to the waste*

Dipendra Nath Sharma

Under the mind-blowing hot sun, a man with his unparalleled devotion for work creeps along a narrow gorge and bravely climbs a cliff with a hammer hanging from his belt and a Brunton Compass in his heavy field bag. There, by the side of the cliff, he finds a suitable rock exposure whose dip and strike he measures with utmost care. All day long, he walks over the thorns with his body bathed in perspiration and keeps on recording each and every detail that comes across him and that he judges is necessary for his table-work. Got him? He is no one but the technical creature having a lust for the science of earth. His name—the Geologist!

Seminars, symposiums and workshops organised at the heart of the country unequivocally acknowledge that the geologists are the need of the day. A country like Nepal, which is situated at the earthquake prone zone and which is susceptible to regular landslides cannot afford to take risks of getting into construction works without proper geological investigations, no matter how small the projects are. But the pity lies in the fact that the responsible authorities do not seem to take the matter seriously.

After carrying out an onerous task of geological investigations along the Mai River banks, Mr. Prabhat Sharma, a recent graduate in geology from the Tribhuvan University (TU), a devoted technocrat who represents the new breed of talent and intelligence, confesses in frustration and anguish, "We, the geologists in Nepal, are being cornered by our planners."

And he has an ample evidence to prove his point.

Jogimara, an ever hungry monster, opens its wide mouth and swallows hundreds of innocent people every year. Several efforts made by the Department of Roads to put this demon to an end have gone in vain. No retaining wall built by the Department has yet been able to check the Jogimara landslide. It has created such a grave situation that the Department of Roads, in absence of any departmental geologist, has been compelled to plead for the help from the experts of the International Centre for Integrated

Mountain Development (ICIMOD). It is really shocking to know that the Department of Roads is supposed to be functioning without a geologist at the table and in the field. Many more Jogimara fame accidents are bound to come into the scenario, if the Department keeps on denouncing the role of geologists.

In a highly terrain like Nepal's, routes always require cuttings and hence blastings. Blastings carried out without proper geological investigations are bound to create problems. Though a lot of debate is in the air about the construction of the Hetauda-Kathmandu tunnel road, a time, let us pray, will come when the travel time minimization philosophy gets clicked and the dream gets realized. But the construction of a tunnel road without a geologist cannot even be imagined.

Water Induced Disaster Prevention Technical Centre (DPTC), which is a project running under the Ministry of Water Resources (MOWR) and which has been concentrating more on landslides has no geologist. It is really hard to imagine how the DPTC has been working out the causes, conditions orientations and characteristics of the landslides and how it has been recommending the required preventive measures for the landslides without technical expertise in the science of earth.

The National Planning Commission of a mountainous country like Nepal, whose 83 per cent of the land is occupied by hills and mountains, which is fragile being subjected to enormous tectonic forces and which possesses deep gorges, fractures, joints, faults contributing to a structurally complex terrain, has lots of geographers but not a single geologist at the hand.

At a stage, when the entire world has been concentrating seriously on environmental protection, formation of the Environment Council has to be welcomed by one and all. Environmentalists in Nepal have been focussing more on plants and animals and polluted air and water ignoring the real cause of environmental pollution, viz., the landslides, earthquakes, soil erosion, volcanism and land use pattern, for

* Source: The Rising Nepal, May 13, 1994

which environmental geologists are being consulted all over the world. But in Nepal, the idea of making use of environmental geologists has not yet been materialized. The Non-Government Organizations (NGOs) spreading like mushrooms and being concerned with environmental protection have not yet found it necessary to exploit the geological expertise.

Soil Conservation Department of the Ministry of Forest and Soil Conservation has few such posts for geologists which have been vacant for many years, but the concerned authority has not yet taken any initiative to fill up the vacancy.

Agricultural geologists, who could serve more to the development of agricultural in Nepal, have no recognition at the government as well as non-government levels.

The Research Centre for Applied Science and Technology (RECAST), run by the TU, consists of scientists from various fields like Zoologists, Botanists, Chemists, Physicists, etc. but not a single geologist. The Pulchowk Engineering Campus, which produces ninety-six civil engineers every year has no such permanent lecturer in geology who could effectively deliver the fundamentals of the science of earth to the

enthusiastic breed of "would be engineers". Similarly, Forest Institutes in Nepal have ignored the importance of geology in forestry.

Consultancies, on the other hand, are found to be inclined towards manipulating and submitting reports without proper geological investigations rather than making use of geological expertise.

A lot of research has been carried out by foreign as well as native geologists on the Himalayas. Nepal Himalaya which occupies the central portion (800km) of the Himalayan arc has always been a matter of interest for many geologists around the world. The more the researches are being carried out the more the mind-riddling puzzles are being revealed. So, it would be a wise thinking on our part to work for the establishment of an institute of Himalayan geology in Nepal.

Today's world is the world of expertise. In this regard, experts from each and every field are to be honoured, their worth evaluated. Nepal, as mentioned earlier, needs the service of geologists for the sustainable infrastructure development. So, it is time that the planners realize the importance of geologists and recognize them.

*Best Wishes and
Hearty Felicitations to*
Nepal Geological Society



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Earth system science for the 21st Century: towards truly sustainable development*

W. S. Fyfe

Our ultimate resources come from the Sun and the Earth system. At this time we face a world crisis in energy, water and soil resources. Global pollution problems are increasing in almost all nations and our climate is changing. There is an urgent need to use our vast knowledge with a new wisdom and this requires new integrated teams of experts to provide the best alternatives for the needed new development problems. These teams must include economists, engineers and a broad spectrum of scientists. Today it is possible to produce clean energy, stop soil erosion, clean water and reduce and use wastes of many types. There is a great need to improve natural science education at all levels. All people must know how our planet works and that fluctuations, some inevitable, some controllable, will occur and that we must prepare for them. And it is clear that protecting the environment, eliminating pollution, preserving biodiversity is good economics. Ecology-Economy cannot be separated.

INTRODUCTION

It is difficult to comprehend the future impact on the earth system the human population increase expected next century. Barring some vast (but not impossible) catastrophe, our numbers will reach over 10 billion. Most of this increased population will live in urban areas with all the complex needs such as improved transport systems, geohazard reduction, and waste management. The situation was well stated recently by Koshland (the former editor of *Science*) 'First of all, it is important to identify the main villain as overpopulation. In the good old days (viewed through the myopia of nostalgia), the water, air, flora and fauna existed in an idyllic utopia. But, in truth, there were famine, starvation, horses and buggies that contributed to pollution, fireplaces that spewed forth soot from burning soft coal, and water contaminated with microorganisms. The humans were so few, and the land so vast, that

these insults to nature could be absorbed without serious consequence. That is no longer true.'

There is a leading question which all educated world citizens must ask. Can we provide adequately for the next five billion without destruction of the most fundamental components of the life support system? This century has been truly remarkable. The scientific giants of the early 1900s (Einstein, Rutherford, Planck, Bohr,...) wrote the rules of modern science and technology, the relations between energy and matter. Their work has stood the test of time remarkably. Their new science led to our present age of observation and information technologies. In large part they contributed to the new medical science which has led to our greater average longevity and the dramatic decline in infant deaths around the world, trends which continue. At the same time, our information systems, in particular television, have led to a new age of expectation. In the forties, Aldous Huxley wrote that we have treated nature with greed, violence and incomprehension. Our planet has become small, and our future common, as stressed in the famous report of the World Commission on Environment and Development, (1987), the Brundtland Report.

The word 'sustainable' has become popular. It is a simple concept and requires the answer to a simple question—'Will I leave the planet in better condition for all species who support me and follow me?' In the recent report from the New Delhi Population Summit (Graham-Smith, 1994), Sir Michael Atiyah, president of the Royal Society of London wrote, 'Most of the problems we face are ultimately consequences of the progress of science, so we must acknowledge a collective responsibility. Fortunately, science also opens up possibilities of alleviating our problems, and we must see that these are pursued.' In the same volume, Sir Crispin Tickell, former British Ambassador to the U.N. wrote 'It would be nice to think that the solutions to some of our present problems could be drawn from past experience, but in this case the past is

* Source: Episodes, Vol. 20, no. 1

a poor guide to the future. Our current situation is unique.'

When we consider the life support system and the future problems faced by *Homo sapiens*, certain key areas are obvious. They include (in no order of priority):

- atmospheric chemistry;
- the radiation field;
- energy resources;
- water resources;
- food resources;
- materials;
- waste management;
- geo-fluctuations, climate fluctuations, and the need for surplus, and
- biodiversity for security

In these brief notes I wish to consider the emerging role of the earth system sciences in achieving sustainable development and providing the necessary resources for all people. It is interesting to note some recent comments in leading journals 'Earth Sciences, job prospects on shaky ground' (Holden, 1994); 'Geological programs come under threat' (Macilwain, 1994); 'Geology is under attack' (Rossbacher, 1995). Are the earth sciences not needed for future sustainable development (Fyfe, 1994)? In a recent editorial in *Chemical Engineering News* (1995), Heylin quotes Stokes of Princeton, 'Better prospects for a new contract for science lie with common recognition of the importance of what he calls use-inspired basic research. He says basic science and technology move ahead together, each, in turn, inspiring and supporting the other in an endless overlapping process. At times, basic science does indeed trigger new technologies, even new industries. Equally, technological needs inspire basic research'.

During the periods of conflict as in the period 1939-45, most scientists became applied scientists. But today, we face a global crisis of far greater magnitude than that of the last world war, the crisis of our survival and responsibility to future generations. We must respond.

Geologic Structures—recent events

As never before, there is need for highly precise geological mapping on scales appropriate to the development problems being considered. Such maps must be precise in describing the timing of events and must be precise in three dimensions. New dating techniques such as those which use cosmic ray induced isotopes can give a new precision on recent fault-fracture

motions, surface erosion and the like. For example, if we consider the growth of megacities, the geological knowledge required to prevent or reduce costly engineering mistakes (e.g. Kobe, Japan) to provide and protect water, to prevent pollution etc., is of a detail and range far beyond most present mapping systems. Recent studies, as with the German deep drilling experiment (the KTB), clearly show that our techniques for deep remote sensing are far from adequate today. I was recently on a field trip with an excellent group of Portuguese (Lisbon University) structural geologists. They were concerned with mapping a region of some interest in terms of a site for nuclear waste disposal. The region was well known for some major fault structures. But their detailed studies, clearly revealed the complexity of the stress patterns and showed that micro-fault systems were present with a frequency distribution of tens of meters. This type of detail is essential to the planning of any major engineering project. At a recent meeting in Norway, Swedish geologists reported on the use of good maps in planning the exact location of new highways resulting in large cost reductions. I will return to other aspects of the types of information required in modern maps below with reference to specific development problems.

Energy problems

At the present time, the bulk of world energy comes from the combustion of coal, oil and gas; all these resources are non-sustainable, natural capital. The thoughtless waste of such valuable resources is a global disaster. Of the fossil carbon sources, only coal and certain types of carbon-rich sediments have resources of interest for more than a few decades. In a general way, there has been little change in burning technologies: -add air-burn-and exhaust to the atmosphere.

There is no need here to discuss the potential future impacts of the climate changes related to the fact that we have rapidly changed the chemistry of the atmosphere. We normally discuss CO₂, CH₄, and acid compounds. But as we have stressed previously (Fyfe and Powell, 1995), many coals contain significant quantities of all halogens F, Cl, Br, I and the steadily increasing ozone catastrophe may be influenced by such combustion. In 1997 ozone hole over the Arctic reached a record size. Also, time after time, the detailed chemistry of coal and coal ash,

is not well known and many coals have significant quantities of elements like uranium and arsenic, and an array of heavy metals immobilized in the reducing, sulfur-rich, medium of coal. Some create problems but many may be useful.

It is certain that nations like China and India will depend on coal for decades to come. Can we change the technology at reasonable cost? Can we reduce the environmental impact of coal combustion? I think the answer is positive. We have been studying the fixation of CO₂ and organics in the cracked, permeable basalts in the caves of Kauai, Hawaii, deep beneath a very heavy forest cover. Every crack is covered with white stuff (silica, clays, carbonates) formed by the action of organics with the basalt, a process mediated by ubiquitous bacterial biofilms. We now know that bacteria can live to depths of over four kilometers, up to 110°C, in favourable locations (Pedersen, 1994 and this issue p.7). Can we use such processes to fix the exhaust gases of coal combustion? For sure, certain rock types will be better than others and volcanics with Ca-feldspars and other Fe-Mg phases should be ideal as in Hawaii. Recently on a field trip in China (east of Beijing), we discussed the possibility of using their rapidly exploited oil-gas fields for disposal of wastes of many types. If a basin isolate oil-gas for millions of years, it surely has capacity to isolate wastes. And generally, oil field structures are well known. A recent publication (Hitchon, 1996) discusses the possibility of combustion gas disposal in sedimentary basins (Fyfe, 1997).

The growing knowledge of the deep biosphere also raises the possibility, with certain types of carbonaceous sediments, of using microorganisms for in situ methane and hydrogen production. In place of opening deep mines with all the related water pollution problems could it be possible to produce biogas (Fyfe, 1996)?

But ultimately, the world must move to solar energy of all types (photovoltaics, wind, tidal) and geothermal energy. There is no shortage of energy sources on this planet. Wind energy use is increasing across the world and photovoltaic devices are becoming more efficient and cheaper (*New Scientist*, 1995). Geothermal sources are normally associated with regions of high heat flow (volcanic systems) but for some purposes (city heating, greenhouses and aquaculture systems), the normal geothermal

gradient can provide background heating. All such potential use requires exact knowledge of deep geologic structures, porosity, permeability and geochemistry.

At the present time only a small fraction of world energy is provided by hydro-electricity. There are regions of the world where there is still potential with river systems (e.g. parts of Africa, Brazil). But there are problems. River flow, runoff, is necessary to keep the land surface clean, particularly with species like salts. Climate, rainfall, is not constant as we have seen dramatically in current years and in dry periods, runoff may be greatly reduced. We now know that major fluctuations and changes in runoff patterns can greatly perturb the marine biomass and even ocean current patterns which in turn can perturb local and global climates (e.g. the Younger Dryas cold event, Fyfe, 1993).

Water

According to Postal (1992), today, forty nations have a crisis of water supply. In many places, uncontrolled extraction of ground water (mining) is being used to promote non-sustainable increase in food production. In vast areas, bad water management has led to salinization of soils and massive pollution by agri-chemical residues. I was recently in Calcutta and, with their Institute for Man and the Environment, was introduced to their major problem of groundwater arsenic pollution which has led to serious health problems with very large numbers of people. Where does the arsenic come from? This problem is not solved but arsenic compounds have been used for a long time in rodent control.

In the developing world, there are few places where the total water cycle is adequately described. While sea level is slowly rising, in many sensitive coastal regions, land subsidence and apparent sea level rise is associated with subsidence and compaction, following the mining of groundwater. Again, exact geoscience is required to describe the water resource potential of any region and to live with the natural fluctuations in precipitation. Recently, Karl et al. (1997) have described changes in weather patterns. On a planet growing warmer there will be more evaporation and more rain somewhere. The new precipitation patterns must be described. Record floods are occurring in many places.

Soil

At this time, at least one billion humans do not have an adequate supply of well-balanced, nutritional food (Sadik, 1989). Across the world, wood is becoming an expensive and declining commodity. Despite the electronic revolution, the use of paper products is increasing (per capita, three-fold in the last 40 years). And the world's marine resources are declining at an alarming rate. Sustainable food-fiber production depends on climate, climate fluctuations, soil quality and water resources. Knowledge from the geosciences is involved in all these parameters. Given that we are not adequately providing nutrition for the present human population, what are the prospects for the next five billion ?

All organisms require a large array and balance of the chemical elements (about 50) for efficient production of the organics needed for life. The geochemistry and mineralogy of soils are critical in estimating the capacity of a soil for sustainable organic productivity. According to the Worldwatch Institute, topsoil loss globally is approaching 1% per year. The technologies exist now for erosion and salinization control but such technologies are not adequately used. But there is great need for new soil maps which clearly show good soils, soils for forests only, and leave it alone ! (Fyfe, 1989; Darnley et al., 1995).

Given the chemical and physical properties of a soil, additives may greatly enhance bio-productivity. Often such additives require the addition of simple mineral materials containing species like K, Mg, Ca, P and appropriate trace metals like Co, Mo, etc. which may be critical in biofunctions like nitrogen fixation. The useful types of additives may be closely linked to soil type and climate. For many situations, as with the laterite soils of the humid tropics, slow release, mineral fertilizers (K in feldspars, rock phosphates) may be more effective and less wasteful than soluble chemical fertilizers. Geochemists and clay mineralogists must become more involved in agriculture.

Materials-minerals-mining

Advanced societies use about 20 tonnes of rock per person per year for their needs. Most is for various forms of construction, highways,

buildings, ceramics, etc. Giant mining operations include those for fertilizers, ores like iron, and coal mining. It is amazing but humans in general are ignorant about where their resources come from, the impacts on the ecosphere, geosphere, hydrosphere of mining operations. With modern understanding of earth convection, our understanding of the resource base and prospecting strategies have dramatically increased. If the world needs more copper, we know where to look and we find it.

But because historically, mining technology has been careless, increasingly many large companies move to developing countries with less stringent environmental laws. For example, I was amazed when the North American Free Trade Agreement (NAFTA) was signed, it was clearly stated that *local* environmental regulations apply. What of the future of the use of mineral resources ? For a population of at least 10 billion projected for next century, we must consider the human modification of 100 km³ of rock per year. Most will be ripped from the near surface, but much from increasing depths where mining perturbs the groundwater resources.

First, the world must move to more efficient recycling and for this to be successful requires careful quality control at all stages of the use-mining to fabrication. In mining, there must first be careful 3D mapping of structures, permeability, porosity, faulting, etc. to accurately assess the environmental impacts. There is great need for extreme quality control in the extraction of ore materials. The total geochemistry must be known, the desirable and the undesirable elements. Such data must be available to plan the mining technology and to assess the environmental impact of the operation. Waste products from mining must be studied for potential uses in construction, soil re-mineralization, etc. The growing knowledge of microorganisms at depths (now over 4 km) opens a host of new technological opportunities. Silica secreting organisms might be used for permeability control. Metal secreting organisms can be used for removal of heavy metals as has been well demonstrated. And a host of new possibilities must be considered for 'in situ' metal extraction via sulfide oxidizing species. The same is true for 'in situ' methane production

from carbonaceous sediments. With all such things there is need for cooperation between geologists, geo-microbiologists, hydro-geologists, engineers and economists. Far too little thought has been given to the end use of mines. In some cases by careful planning, these could become waste disposal sites for urban areas, a growing world problem.

I think there is no doubt, that with the correct team for planning *from the start*, the environmental impact of extracting resources from the crust can be vastly reduced. And I am sure that in many cases, the long term economics of the operation will be improved. We must also watch for new needs. I was interested to read in the British journal *The Economist*, that there is a world shortage of high purity silicon for modern electronic devices, and soon we will see vastly increased use of photovoltaics. For such purposes, there is a giant difference between 99.99% SiO_2 and 99.9999% SiO_2 .

I have always been intrigued by the possibilities for use of near ocean ridge sites for metal extraction and energy production (cf the Salton Sea Thermal fields). On Canada's well-described Juan de Fuca system, by drilling through the impermeable, sediment cover with thermal gradients of up to $300^\circ\text{C}/\text{km}$, one might simultaneously extract metals and energy.

Waste management

This century will go down in history as that of careless technologies and waste production. There is no doubt that the long term costs can be staggering (as with the arsenic pollution in India mentioned above). The complexity of modern waste is enormous, from organics, to radionuclides, urban garbage, etc. And it is amazing that the nuclear industries developed before any serious attention was given to wastes—the we will do it when necessary philosophy. Ontario, Canada, where nuclear electricity dominates the system, now estimates that it will spend at least 15 billion dollars on nuclear waste disposal in the next decades and at this time no 'best' site has been proposed. And it is strange that only recently has a combustion gas like CO_2 been considered a waste product. Combustion has changed the concentration of many critical components of the Earth's atmosphere.

I think the time has come to drastically change our philosophy on wastes. First we must precisely describe the nature of waste, chemistry, etc. Then we must search for uses for the waste and reorganize that time after time it can be a resource. Denmark recycles 97% of its paper, Canada 17%. And the secret of domestic waste management is the five minutes a day spent in separating the components. As mentioned above, we have shown that by using careful geochemistry, many types of coal ash (but not all) can be a valuable soil additive. The same is true for most urban sewage as long as it is not mixed with other toxic wastes from say the chemical industries. Again we need teams of the appropriate scientists, not just engineers! One case I would like to again emphasize is that of the gas products from combustion, CO_2 , NO_x , SO_x , and as we have shown with halogen-bearing coals which are common, possible halogen-organics. Are the latter partly responsible for the growing problems of stratospheric ozone destruction? As mentioned above, can we dispose of these gases below ground and not simply vent to the atmosphere? The cost reduction on public health of reducing all the lung problems might well cover the additional engineering costs. Japan is seriously considering the marine dumping of CO_2 (Fyfe, 1997).

Every waste product requires unique approaches. Many wastes can be resources, and for most secure disposal is possible. For geological disposal we require a new precision in the total description of the subsurface environment.

Geo-fluctuations

There is no need here for lengthy discussion of the problems of the inevitable geo-fluctuations that occur. The Earth environment is not, never was, never will be, constant. Causes of fluctuations, the year without summer, are complex but must be considered in the life support system. They imply that for security there must be surplus and there must be biodiversity. I think one can predict with certainty, that given population growth and present planning systems, the next events like the mega-volcanic eruptions of early last century, will see a vast social catastrophe unless we are prepared to plan now and face the new realities.

CONCLUSION

As world human population continues to grow, to move to over ten billion next century, the need for exact geoscience must be a priority in planning the needed future development of the support systems. And there is urgent need to improve the communication and effective cooperation between all the experts in modern science and technology, and economists, engineers, politicians and all educated citizens. At this time Europe leads in demonstrations that sound economic and environmental policies are not in conflict but must form a working partnership. We must and can reduce pollution and wastes. We must recognize the limits of the Earth system, we must develop holistic natural science. Given the future numbers of humans on Earth, the cost of errors will become intolerable. Earth and planetary science must and can be introduced into our school curricula at all levels with the objective of education for global responsibility.

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समस्यै, समस्या बीचको नेपाली वातावरण पत्रकारिता

मोहन मैनाली

पृष्ठभूमि

नेपालको पत्रकारिता उमेरका हिसाबले सय वर्षको आसपास छु भन्ने गरिए पनि यो उमेर प्रकाशनको हो-पत्रकारिताको होइन । वास्तवमा २००७ सालपछिको प्रकाशनले मात्र पत्रकारिताको भूमिका निर्वाह गरेकोले यसको इतिहास लामो छैन भन्ने हुन्छ । २००७ सालदेखि २०१७ सालसम्म नेपाली पत्रकारिताले स्वतन्त्रता उपभोग गर्न पाए पनि ०१७ सालदेखि २०४६ सालको अन्त्यसम्म नेपाली पत्रकारिताले पूर्णरूपमा आफ्नो भूमिका निर्वाह गर्न सकेन । अर्थात् तन्त्र सधैं जिर्ण अवस्थामा रहेको हाम्रो देशमा पत्रकारिताको पूर्ण विकासका लागि अझै पनि धेरै आर्थिक कठिनाइहरू छुँदैछन् ।

परम्परागत पत्रकारिता

संसारमा पत्रकारिताको उदय पश्चात् लामो समयसम्म यसको भूमिका नयाँ कुरा अथवा घटनाका बारेमा जानकारी दिनै मात्रै रह्यो । घटनाप्रधान पत्रकारिताले समाजलाई आवश्यकता अनुसार डोहोल्याउन नसकेको महसूस भएपछि पत्रकारिताले पनि आफ्नो कार्यक्षेत्र विस्तार गर्दै लग्यो । पत्रकारहरूले कुनै घटनाका बारेमा समाचार दिएर आफ्नो दायित्व पूरा भएको ठान्छन् । उनीहरूको ध्यान घटनामा मात्र होइन घटनाका कारक तत्व र त्यसबाट समाजमा पर्ने विविध प्रभावहरूतर्फ पनि गयो । अहिले आएर पत्रकारहरूले समाजका हरेक विषयमा सूचना दिने, शिक्षा दिने, अग्रिम चेतावनी दिने, विश्लेषण गर्ने, अभियान चलाउने, जनमत तयार गर्ने र निगरानी राख्ने कामलाई आफ्नो कामका रूपमा स्वीकार गरेका छन् । यसो भएमा मात्रै पत्रकारिताले राज्यको चौथो अङ्गको भूमिका निर्वाह गरेको ठहर्छ । आज भोलि राजनीति, विकास, वातावरण लगायतका जुनसुकै क्षेत्रमा काम गर्ने पत्रकारहरूले पनि आफ्नो यस भूमिकालाई स्वीकार गरेका छन् ।

कठिनाई

तर यस्तो भूमिका निर्वाह गर्ने काम सरल भन्ने छैन । यस्तो भूमिका निर्वाह गर्ने क्रममा पत्रकारहरूले अनेकन बाधा, व्यवधानहरूको सामना गर्नुपर्ने हुन्छ । राजनीति, अशिक्षा आदि जस्ता विस्तारै भयानक दुष्परिणाम ल्याउने (मन्द गतिका) प्रकोपका विषयमा पत्रकारहरूले आफ्नो काम

गर्नका लागि अलि बढी समय पाउँछन् । तर द्रुत गतिमा भैरहेका र हुने विपत्तिको सम्बन्धमा लेख्ने तथा श्रव्य र श्रव्यदृश्य सामग्री तयार गर्न पत्रकारहरूले एकदमै थोरै समय मात्र पाउने हुनाले उनीहरूले थप समस्या भोग्नुपर्ने हुन्छ ।

सामाजिक, राजनीतिक तथा आर्थिक क्षेत्रमा काम गर्ने पत्रकारहरूले भन्दा विपत्ति लगायत वातावरण, विज्ञान र भूगर्भ सम्बन्धी विषयमा काम गर्ने पत्रकारहरूले अझ बढी समस्या भोग्नुपर्छ । यस्ता समस्याहरू निम्न बमोजिम छन्:-

(क) जटिलता:

कुनै पनि विषयमा लेख्ने वा सामग्री तयार गर्ने कामको पहिलो पाइला विषयको छनौट हो । कुनै पनि विषयमा पत्रकारले रिपोर्टिङ गर्न निस्कनु अघि नै त्यस विषयका बारेमा जानेको हुनुपर्छ । त्यस विषयको पृष्ठभूमि जान्नुपर्छ । त्यस विषयसँग सम्बन्धित संस्था, निकाय वा विशेषज्ञ वा पीडित पक्षका बारेमा थाहा पाएको हुनुपर्छ । यसो भएमा मात्र उसले रिपोर्टिङ गर्ने विषयको छनौट गर्न सक्छ, सहि जवाफ पाउन सही मान्छेसँग कुरा गर्न सक्छ, सही ठाउँमा पुग्न सक्छ जसले गर्दा उसले सही जानकारी लिएर आफ्ना पाठक/दर्शकसम्म पुर्‍याउन सक्छ ।

तर विपत्ति लगायत वातावरणयि विषयहरू गैर विशेषज्ञका लागि जटिल हुन्छन् । त्यसैले पत्रकारहरूलाई विषय छान्न, सही व्यक्तिसँग कुराकानी गर्ने, पृष्ठभूमि बुझ्न र जानकारी लिन कठिन पर्छ । यस्तो कठिनाइको प्रभाव उसले तयार गरेका सामग्रीमा पर्नु अनौठो कुरा होइन ।

(ख) अनिश्चितता:

वातावरणीय विषयहरू अनिश्चित हुन्छन् । कुनै ठाउँमा विपत्ति पर्छ वा पर्दैन भन्ने कुरा धेरै हदसम्म अनिश्चित हुन्छन् । कतिपय अवस्थामा विपत्ति कसरी भयो र त्यसका कारण के हुनसक्छन् भन्ने कुरा पनि अनिश्चित हुन्छन् । त्यसैले, पत्रकारहरूले 'अज्ञात रोगबाट यति मान्छे मरे' भन्ने जस्ता समाचार लेख्नु पर्ने हुन्छ ।

छो-रोल्पा हिमताल फुट्छ कि फुट्दैन ? यसबाट मानिसहरूले तत्कालै डराउनु पर्छ कि पर्दैन ? अथवा कुन कुन ठाउँका मानिसहरू शर्तक रहनुपर्छ ? यसबाट पर्ने प्रभाव कम गर्न अपनाइएका अमूक उपाय प्रभावकारी हुन्छन्

कि हुँदैनन् भन्ने जस्ता विषयमा विशेषज्ञहरू बीच नै मत भिन्नता पाइन्छ । विशेषज्ञहरू बीच यस्तो मत भिन्नता आफ्नो ज्ञान र विवेकका साथै आफ्नो र आफू काम गरिरहेको संस्थाको स्वार्थ अनुसार पनि हुने गरेको पाइएको छ । यस्तो अवस्थामा ती विषयमा बृहत जानकारी नभएका तर रिपोर्टिङ गर्न चाहने पत्रकारहरू अलमलमा पर्छन् । अलमलमा परेका मान्छेले तयार गरेको सामग्री पढ्ने/सुन्ने/हेर्ने पाठक/दर्शक अलमलमा पर्नु अनौठो कुरा होइन ।

(ग) असंगत मान्यता, अमान्य सीमा र निष्कर्ष:

कुनै विषयमा त्यही क्षेत्रमा काम गर्ने विशेषज्ञहरू बीच मत भिन्नता नभएपछि उनीहरूले राखेका असंगत मान्यता र प्रतिनिधित्व गर्न नसक्ने स्पष्टावलीको अध्ययनका आधारमानिकालिएका निष्कर्षलाई सही निष्कर्ष मान्न त्यस क्षेत्रभन्दा अन्यत्रका मानिसलाई गाह्रो पर्छ । जङ्गल नभएका ठाउँलाई पनि जङ्गल मानेर निकालिएको जङ्गलको क्षेत्रफल जङ्गल बाहेक अन्य क्षेत्रका मानिसले पत्याउने कि नपत्याउने ? कहिले काहिँ त्यस यस्तो स्थितिमा पत्रकारहरू पनि अलमलमा पर्छन् ।

(घ) सूचना/जानकारीको प्रभाव:

विपत्ति लगायत धेरैजसो वातावरणीय विषयमा सरकारी, अर्धसरकारी अथवा गैर सरकारी निकायबाट जानकारी प्राप्त गर्न धेरैजसो अवस्थामा कठिन पर्छ । प्राप्त जानकारीहरू पनि संस्थाको स्वार्थ अनुसार भिलाइएका हुन्छन् । सूचना प्रवाहलाई रोक्ने हास्रो संस्कार पनि पत्रकारहरूको लागि ठूलो समस्या बनेको छ ।

(ङ) प्राविधिक शब्द:

विज्ञान, प्रविधि, भूगर्भशास्त्र, जलवायु विज्ञान, स्वास्थ्य लगायतका क्षेत्रका प्राविधिक शब्दावलीहरू पत्रकारहरूका लागि ठूला शत्रु हुन् । एमसिटि, एमबिटि, प्युठान र नुवाकोट र ताप्लेजुङ विन्डो, मर्करी कम्पाउण्ड, डर्टी ड्रजन आदि जस्ता शब्दलाई सर्वसाधारणले बुझ्ने बनाउने काम पत्रकारका लागि फलामका चिउरा चपाउनु भन्दा कठिन काम हो ।

भनाइ/उद्गारको अभाव

विपत्ति लगायत वातावरणीय विषयमा कतिपय अवस्थामा जानकारी प्राप्त भए पनि यसको जिम्मेवारी कसैले लिन चाहँदैन । कतिपय अवस्थामा कुनै विशेषज्ञले

कुनै विषयमा अर्को विशेषज्ञले भनेभन्दा फरक मत राख्छ वा भैरहेका काम कारवाहीमाथि प्रश्न गर्छ तर उसले आफ्नो नाम प्रकाशमा नआओस् भन्ने चाहन्छ । पत्रकारले विशेषज्ञका हैसियतमा गरिने प्रश्न गर्नु भएन । पत्रकारले जानकारी/सूचना/तथ्याङ्क आफै उब्जाएँ भन्नु भएन । तिनको प्रमाणिकताका लागि पनि स्रोत अधिकांश अवस्थामा आवश्यक हुन्छ । यसको अभावमा पत्रकारले 'विश्वस्त सूत्रका अनुसार' 'एक विशेषज्ञको चुनौति' भन्ने जस्ता शब्दावली प्रयोग गर्नुपर्छ । विशेष अवस्थामा बाहेक यी शब्दको प्रयोग गरेका खण्डमा पाठक/स्रोत/दर्शकले पत्रकार पूर्वाग्रही भएछ भनेर त्यस्ता जानकारी र तर्कलाई ग्रहण गर्दैन ।

यी बाहेक पत्रकारहरूले सामग्री तयार गर्ने समयको अभाव, छान्ने ठाउँ वा रेडियो टिभिमा समयको अभाव, सम्पादकलाई आफूले सामग्री तयार गरेको विषयको महत्त्व बुझाउने, आन्तरिक तथा बाह्य दबाव जस्ता समस्या पनि भोग्नु पर्छ ।

समाधानका उपायहरू

नेपाली पत्रकारितामा पत्रकार र राजनीतिज्ञ बीचको अन्तरक्रिया, विचार आदानको प्रभाव अत्यधिक मात्रामा पाइन्छ । केही समय यता नेपालमा काम गरिरहेका दातृ संस्था, राष्ट्रिय तथा अन्तर्राष्ट्रिय गैर सरकारी संस्था र पत्रकारहरूको अन्तरक्रियाको प्रभाव पनि नेपाली पत्रकारितामा भेटिन थालेको छ । तर विपत्ति लगायत वातावरणीय विषयसँग सम्बन्धित विषयका विशेषज्ञहरू र पत्रकारहरू बीच छलफलको अत्यन्तै अभाव खटकिइरहेको छ ।

गैर राजनीतिक विषयले पनि संचार माध्यममा महत्त्व पाइरहेका समयमा पत्रकारहरूलाई यस्ता विषयको महत्त्वबारेमा बताउनु पर्ने अवस्था छैन । तर विषयको छनौट गर्ने, त्यस सम्बन्धी जानकारी हासिल गर्ने, कुराकानी गर्न सम्बन्धित उपयुक्त व्यक्ति पत्ता लगाउने र प्राविधिक शब्दावलीलाई सरल बनाउने काममा पत्रकारहरूलाई विशेषज्ञहरूको सहयोगको खाँचो छ । त्यसैगरी, अरूका बारेमा ठीका टिप्पणी गर्नका लागि बाँचेका पत्रकारहरूले गरेका गल्ती, कमजोरी बारेमा पनि सम्बन्धित विज्ञ तथा पाठकहरूबाट ठीका टिप्पणी भएमा उनीहरूले पनि आफूलाई सुधार गर्ने मौका पाउँछन् । फेरि त्यस्ता गल्ती नदोहोरिउन भनेर शतर्क हुन सक्छन् ।

पत्रकार र विशेषज्ञहरू बीचको अहिलेको दूरी घटाउँदा दुवै पक्षलाई फाइदा पुग्न जान्छ । यसो गर्दा यी दुई क्षेत्रका पेशेवरहरूलाई फाइदा पुग्दैन भने पनि आम जनताका लागि भने अवश्यै पनि फाइदा पुग्छ ।

New Members of Nepal Geological Society

| Membership Name No. | Mailing Address |
|---------------------------------|---|
| LM-389 REGMI Kamal Raj | Central Department of Geology, Kirtipur |
| LM-390 SHRESTHA Bibak Kumar | Baneswor -34, Kathmandu |
| LM-391 PIYA Birendra | Dept. of Mines and Geology, Lainchaur, Kathmandu, Nepal |
| LM-392 DWIVEDI Shree Kamal | WESC, Singha Durbar, Kathmandu, Nepal |
| M-393 NAPIT Dinesh Kumar | Kaligandaki Hydro Power Project |
| M-394 BHATTARI Dushantha | Nepal Metal Company, Kathmandu, Nepal |
| LM-395 SHRESTHA Puspa Lal | Soil, Rock and Concrete Labarotary, NEA, Kathmandu, Nepal |
| LM-396 SHRESTHA Manohar | Department of Mines and Geology, Lainchaur, Kathmandu, Nepal |
| M-397 MULMEE Mahesor Raj | Kathmandu, Nepal |
| M-398 DAHAL Rajan Kumar | Kathmandu, Nepal |
| M-399 ARYAL Arjun | Department of Geology, Trichandra Campus Ghantaghar, Kathmandu, Nepal |
| LM-400 FUNAKAWA Satoshi | JICA Nepal Office, P.O.Box. 450, Kathmandu, Nepal |
| M-401 BHANDARI Babu Krishna | Ilam Hydropower Project, Ilam |
| M-402 PANDIT Rajesh | Soil, Rock and Concrete Labarotary, NEA Kathmandu, Nepal. |
| M-403 ADHIKARI Bishnu Prasad | Kaligandaki Hydropower Project, Kathmandu, Nepal. |
| M-404 SHRESTHA Rajendra | P.O.Box. 11728, Kathmandu, Nepal |
| LM-405 DAHAL Khila Nath | Dept. of Irrigation, Jawalakhel, Lalitpur, Nepal |
| M-406 KAFLE Kumud Raj | Kathmandu, Nepal |
| M-407 WALI Churana Bahadur | Mid Western Irrigation Directorate, Birendranagar, Surkhet, Nepal |
| M-408 DHUNGEL Shashi Kumar | Kathmandu, Nepal |
| LM-409 MD.SULTAN-UI-Islam | Dept. of Geology and Mining, University of Rajshahi, Rajshahi-6205, Bangladesh |
| LM-410 SATTAR Golam Shabbir | Dept. of Geology and Mining, University of Rajshahi, Rajshahi-6205, Bangladesh |
| LM-411 NEUPANE Rajendra | Dept. of Irrigation, GWRDP, Field Office Nepalganj |
| LM-412 ACHARYA Subhrangsu Kanta | 15, Dr. Sarat Banerjee Road, Calcutta-700029, India |
| LM-413 HIGAKI Daisuke | P.O.Box. 450, JICA Nepal Office, Kathmandu, Nepal |
| LM-414 PAUL S.K. | Wadia Institute of Himalayan Geology, Dehradun, India |

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Bio-data of Hon. Members of Nepal Geological Society

I. Dr. Chandra Kant Sharma



1. DATE OF BIRTH: 13.3.1936

2. QUALIFICATIONS:

| | Institution | Year | Degrees | Specialization |
|----|--|-------------|--------------------------------|------------------------------------|
| a) | Indian School of Mines, Dhanbad India | 1954-58 | B.Sc. (Hons) M.Sc. A.I.S.M. | Applied Geology Applied Geology |
| b) | Aligarh Muslim University, India | 1960-62 | Ph.D. | Geology |

3. MEMBERSHIPS OF PROFESSIONALS SOCIETIES:

- a) National Water Well Association of USA
- b) Society of Economic Geologist of USA
- c) Nepal Geological Society of Nepal

4. ACADEMIC ACTIVITIES:

- a) Invitee lecturer to Staff College of Nepal from time to time in the field of Water and Energy Resources.
- b) Member of Instruction Committee on Geology of Tribhuvan University, Kathmandu, Nepal.
- c) Member of Academic Council of Tribhuvan University for 1987-89.
- d) Invitee Examiner of Nepal Public Service Commission in the field of Geology from time to time.
- e) Editor-in-Chief of Journal of Nepal Geological Society from 1980-82
- f) Member of Committee to draft a proposal for Organising a Water Resources Institute under Tribhuvan University of Nepal.

5. MEMBER OF NATIONAL COMMITTEE:

- a) Member of National Resources Conservation Commission.
- b) Member of Coordinating Committee in Karnali (Chisapani) Multipurpose Project.

6. TECHNICAL EXPERT:

- a) Landslide at Kulekhani Reservoir.
- b) Flood Impacts to Sunkosi, Trisuli and Devighat Hydro Electric Projects.
- c) Member Committee to find Causes of Failure of Phewa Dam and non-functioning of Chapakot Tar Irrigation Project.
- d) Member of Committee to Investigate Groundwater Quality and Quantity in Kathmandu Valley.
- e) Consultant to Agriculture Projects Services Centre in the field of Groundwater of Western Terai in Tube Well.

7. SUPERVISION WORK:

- a) Local Supervisor for two German students for Ph.D. work in Geology of Nepal from the University of Erlagen in 1988.
- b) Local Supervisor for M.Sc. students from Erlagen University in 1987.
- c) Local Supervisor for M.Sc. work in Groundwater for American students from Syracus University of USA.
- d) Supervisor for one Nepali student for Ph.D. work under Tribhuvan University.

9. AWARD OF DISTINCTION:

- a) "Mahendra Vidya Bhusan" Medal of Nepal for academic achievement.
- b) "Gorkha Dakshin Bahu" 3rd order Medal for meritorious work in developing Groundwater Resources of Nepal.
- c) Appointed as life long Academician to Royal Nepal Academy of Science and Technology (RONAST) for contribution in science and technology.

10. PUBLICATIONS:

| Books | Year | Page |
|--|------|------|
| a) Geology of Nepal | 1973 | 189 |
| b) Groundwater Resources of Nepal | 1974 | 140 |
| c) Natural Resources of Pokhara Valley | 1975 | 106 |
| d) Landslides and Soil Erosion in Nepal | 1976 | 93 |
| e) River Systems of Nepal | 1977 | 214 |
| f) Natural Resources of Nepal | 1978 | 271 |
| g) Nepal and Nepalese | 1979 | 175 |
| h) Water and Energy Resources of Himalayan Block (Bhutan, Nepal, Bangladesh, Pakistan and India) | 1983 | 477 |
| i) Natural Hazards and Man-Made Impacts in Nepal Himalaya | 1989 | 150 |
| j) Geology of Nepal Himalaya & adjacent countries | 1990 | 470 |
| k) Engineering Challenges in Nepal Himalaya | 1991 | 200 |
| l) Mineral Resources of Nepal | 1995 | 142 |
| m) Some Symptoms of Environmental Degradation in Nepal, (1950-1994) | 1995 | 171 |
| n) Shallow (Phreatic) Aquifers of Nepal | 1995 | 272 |
| o) A treatise Resources of Nepal | 1987 | 493 |

11. PUBLISHED PAPERS:

- | | |
|---|--|
| a) Partial Drought Condition in Nepal | Hydro-Science London. |
| b) Geological Studies in Nepal | Himalayan Geology, India |
| c) Stratigraphy of Nepal | Stratigraphy of Himalaya, India |
| d) Geotectonics of Kathmandu Block | J. of Nepal Geological Society |
| e) Integration of Surface Water and Groundwater as a Necessity of Nepal | ICID Delhi |
| f) Chemical Pollution of Soil and Groundwater in the Kingdom of Nepal | International Symposium on Groundwater Monitoring Dresden G.D.R. |

| | | |
|----|--|--|
| g) | Oil Investigation in Nepal | ESCAP |
| h) | The Problem of Sediment Load in the Development of Water Resources | Mountain Research Development in Nepal |
| i) | Nepal's Hydro schemes progress and plans | Water power dam construction UK |
| j) | Developing Nepal's water (Joint paper with Dr. H.M. Shrestha) | Electricity International UK |
| k) | Energy and Environment and Nepal | Ambio Sweden |
| l) | Overview of Nepals energy sources and environment | Atmospheric Environment UK |

12. CONTRIBUTIONS (as a Coordinator and Reviewer)

| | | |
|----|---|----------------------|
| a) | Soil Erosion and Sedimentation in Nepal Himalaya | IDRC, WEC and ICIMOD |
| b) | Glacial Lake Outburst Flood in Nepal | IDRC |
| c) | Report on Sino-Nepal Joint Expedition to Glacial Lake in Tibet. | |
| d) | Rock Mechanics Seminar held in Kathmandu. | |
| e) | Earthquake and its Implication in Civil Structures held in Kathmandu. | |
| f) | Soil Erosion Sedimentation in Nepal Himalaya held in Kathmandu. | |
| g) | Reviewed landslides papers of India and Pakistan for ICIMOD | |

13. SERVICE RECORDS:

May 9th 1988 - Nov. 7, 1992 (Retired from HMG Service)

Actg. Executive Secretary of Water and Energy Commission responsible for management and coordination of the six Directorates of Water and Energy Commission Secretariat, in particular as an Executive Secretary, the following contributions were made:

- Mostly organizing and gearing up the six divisions (data), water resources, institution and manpower, energy, economics and international law.
- Systematise the administrative procedures in line with HMG rules. Decentralized the system in order to make each directorate most effective.
- Plans and programmes were developed in such a fashion that they were achieved in time. Budget were well articulated so that there is no discrepancy between budget and programme.
- Distinct contributions in the field of water and energy resources have attracted even International Agencies such as IBRD and ADB Manila to water and energy commission either as a reference point of data or advice on certain specific code. Sometimes even they requested the Secretariat to be an executive agency for their specific water and energy related studies in Nepal.
- Overall responsibility in the management, administration and proper conduct of Management and Improvement of Farmers' Irrigation Systems in the Sindhupalchok District of Nepal. This project was assisted by Ford Foundation, in which IIMTs contribution was also immense.
- Management of technical assistance of WECS from Canadian International Agency (CIDA) in Water and Energy Sectors.

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II. Mr. Puspa Bhakta Malla

नाम : पुष्पभक्त मल्ल
 जन्म मिति : वि.सं. १९७० माघ
 ठेगाना : ग-२-२ काठमाडौं-२, डिल्लीबजार २१/५३८ वार्ड नं. ३३
 जन्मस्थान : क्वाठचोक, खौमाटोल, भक्तपुर
 पिता : श्री विष्णुभक्त मल्ल (मध्यमस्तरको जीविकोपार्जन)
 शिक्षा : निम्न माध्यमिक विद्यालय, भक्तपुर



माध्यमिक विद्यालय (दरबार हाईस्कूल)

अभिभावक श्री सु. कृष्ण गोपाल सालिकेको सौजन्यबाट उहाँको घरमा, भू.पू. बडा काजी श्री मरीचमान सिंहबाट बरोबर आर्थिक सहायता ।

१९९० सालको प्रथम नेपालको एस.एल.सी. बोर्डका परीक्षामा बोर्डमा प्रथम स्थान प्राप्त गरी दोश्रो श्रेणीमा उत्तीर्ण ।

त्रिभुवन चन्द्र (त्रि-चन्द्र) कलेजमा इन्टरमेडियट साइन्सको अध्ययन ।

१९९४ सालमा पाटना विश्वविद्यालयबाट आई.एस्सी. पास ।

बाराणसी हिन्दू विश्वविद्यालयमा खानी विषय (Mining Engineering) ४ वर्षको स्तानक अध्ययन अवधि पश्चात् १९९८ सालमा दोश्रो श्रेणीमा उत्तीर्ण ।

सेवा : १९९८ सालमा ६ महिने म्यादि मासिक रु. ९०/- मा खानी अड्डा ।

१९९९ सालदेखि स्थायी सहायक अभियन्ता (Engineer) खानी अड्डा ।

२००६ सालदेखि स्थायी सहायक अभियन्ता (Engineer) खानी अड्डा ।

२००९ सालदेखि स्थायी सहायक अभियन्ता (Engineer)

२००९/०१० सालमा संयुक्त राज्य अमेरिकामा प्रशिक्षण

२०१२ सालदेखि अभियन्ता (Engineer)

२०१४ सालमा १ महिनासम्म भारत सरकारको सौजन्यपूर्ण नियन्त्रणमा भू.पू. निर्देशक क. खड्ग नरसिंह राणाको नेतृत्वमा विभिन्न खानी तथा खानीजन्य उद्योगहरूको निरीक्षण भ्रमण ।

२०१४ सालदेखि कायम मुकायम निर्देशक खानी विभाग ।

२०१६ सालमा स्थायी निर्देशक खानी विभाग ।

२०२१ सालमा पश्चिम जर्मनीको सौजन्यपूर्ण निमन्त्रणामा बर्लिन शहरमा खानी तथा पानी सदुपयोग विषयको १ महिनाको सेमिनारमा सहभागी ।

२०२३ सालदेखि नोकरी ३३ वर्ष ९ महिना पुगेकोले सेवाबाट निवृत्तभरण पाई सरकारमा आवश्यक परेमा पुनः सरकारी सेवा गर्न पाउने गरी अवकाश

२०२५ सालमा खनिज सम्बन्धी निजी क्षेत्रमा सेवा ।

२०२९ देखि २०४२ सम्म साझेदारीमा ढुङ्गा खानी उद्योग । हाल खानी रोक्का ।

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Obituary

Dr. Chandra Kant Sharma (1936-1998)



Dr. Chandra Kant Sharma died in Janaury, 1998.

Dr. C.K. Sharma was born on March 13, 1936. Late Sharma had obtained B.Sc. (Hons.) in Applied Geology from Indian School of Mines, Dhanbad, India and M.Sc. in Applied Geology from Indian School of Mines, Dhanbad, India in 1958. He had received his Ph.D. degree from Aligarh Muslim University, India in 1962. Late Sharma also received various other trainings in mineral and groundwater exploration techniques.

Late Sharma had made great contribution in the development of Geology of Nepal. He was the only Nepalese geologist who had written books on geology and groundwater resources of Nepal. In addition to a number of professional papers in national and international journals, he had published 15 books on geology, groundwater, hydrology, engineering geology and mineral resources of Nepal.

Late Sharma had worked in many government offices starting from the Department of Geology and Mines to Department of Irrigation to Water and Energy Commission Secretariat (WECS). He was Acting Executive Secretary of WECS, when he was retired from HMG service in November 7, 1992.

Besides his government service, he had made significant contribution in development of Geological sciences. He was the Member of Subject Committee on Geology of the Tribhuvan University. He was visiting professor of the Central Department of Geology, Kirtipur Campus, Tribhuvan University.

Late Sharma was life-long Academician of the Royal Nepal Academy of Science and Technology (RONAST). He had also received "Gorkha Dakshin Bahu" 3rd order Medal for meritorious work in developing Groundwater Resources of Nepal. He was also member of National Resources Conservation commission and Coordination committee in Karnali (Chisapani) Multipurpose Project.

Late Sharma had made a big contribution towards the development of the Nepal Geological Society. He was the founder and life member of the Nepal Geological Society. He had been the Editor-in-Chief of the Journal of Nepal Geological Society for a number of years.

The Nepal Geological Society expresses its deepest sorrow at the sad demise of Dr Chandra Kant Sharma.



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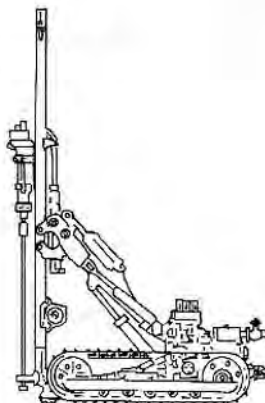
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Frequently Asked Questions on Earthquake

(Facts & Figures)

1. What is the definition of an earthquake?

An earthquake is the sudden, sometimes violent movement of the earth's surface from the release of energy in the earth's crust.

2. How many earthquakes happen each year?

There are over a million quakes annually, including those too small to be felt.

| Description | Magn. | Freq. / year |
|-------------------------|---------|--------------|
| Great | 8.0+ | 1 |
| Major | 7.0-7.9 | 18 |
| Large (destructive) | 6.0-6.9 | 120 |
| Moderate (damaging) | 5.0-5.9 | 1,000 |
| Minor (damage slight) | 4.0-4.9 | 6,000 |
| Generally Felt | 3.0-3.9 | 49,000 |
| Potentially Perceptible | 2.0-2.9 | 300,000 |
| Imperceptible | <2.0 | 600,000+ |

3. How many earthquakes happen every Month? Day? Minute? and Second?

Per month Approximately 80,000

Per day ... Approximately 2,600

Per minute ... Approximately 2

Per second ... Approximately 1 every 30 secs.

Of these only a relative few are capable of causing damage.

4. How deep do earthquakes occur in the World?

Earthquakes occur in the crust or upper mantle which ranges from the surface to about 800 kilometers deep.

5. How much energy is released in an earthquake?

Earthquakes release a tremendous amount of energy, as shown below

| Magn. | Energy Released (TNT Equivalent) |
|-------|----------------------------------|
| 4.0 | 6 tons |
| 5.0 | 199 tons |
| 6.0 | 6,270 tons |
| 7.0 | 199,000 tons |
| 8.0 | 6,270,000 tons |
| 9.0 | 99,000,000 tons |

6. Where did the largest known earthquake occur?

A magnitude 9.5 earthquake in Chile in 1960 was the largest known earthquake and resulted in over 6,000 deaths.

7. What was the greatest number of people killed in one earthquake?

An earthquake in China in 1556 killed approximately 830,000 people

8. What does an earthquake feel like? How long does the ground shake?

Generally, during an earthquake you will feel a swaying motion, then a slight pause, followed by a more intense rolling or jerking motion. The duration of the shaking depends on the earthquake's magnitude, the distance from the epicenter, and the geology of the ground. Shaking at a site with soft sediments, for example, can last 3 times as long as shaking at a stable bedrock site such as one composed of granite.

9. At what magnitude will damage begin to occur?

Earthquakes can be described in two ways: by magnitude and intensity. Magnitude is often called "Richter Scale" although other magnitude scales are more commonly used now. Magnitude is a measure of the amount of energy released at the focus (point of origin) of an earthquake. Intensity, refers to the effect of an earthquake. Intensity is measured by the Modified Mercalli Intensity Scale, using Roman numerals I-XII. Magnitude is mathematically calculated, intensity is based upon observation. While a single number expresses the magnitude of an earthquake, intensity of a earthquake varies by location. Factors affecting the intensity of an earthquake on an area include magnitude, distance from the focus, and local geology. The approximate relationships between magnitude and intensities:

| | | | | | |
|--------------|---------|---------|----------|---------|---------|
| Mag. 3.0-3.9 | 4.0-4.9 | 5.0-5.9 | 6.0-6.9 | 7.0-7.9 | 8.0-8.9 |
| Int. II-III | IV-V | VI-VII | VII-VIII | IX-X | XI-XII |

10. What should I do during an earthquake?

IMMEDIATE ACTION

Indoors:

- Do not rush outside. Get your family into doorways, under tables, or if they are bedridden, under their beds, keep away from windows and chimneys.

Outdoors:

- Keep clear of buildings, high walls or dangling electric wires. If you are in a city, seek shelter under archways or doorways but do not re-enter damaged buildings.

Driving:

- If you feel the earthquake when riding in a car or bus, ask the driver to pull over and stop. Stay inside
- If you feel the earthquake when riding in a car or bus, ask the driver to pull over and stop. Stay inside the vehicle.



For further details, please contact:

National Society for Earthquake Technology-Nepal

National Member for International Association of Earthquake Engineering (IAEE)

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**Best Wishes and Hearty Felicitations
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